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UNITED STATES COAST PILOT

ATLANTIC COAST

SECTION D

CAPE HENRY TO KEY WEST

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DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
O. H. TITTMANN, SUPERINTENDENT

UNITED STATES COAST PILOT

ATLANTIC COAST

SECTION D

CAPE HENRY TO KEY WEST

UNIV. OF

PRICE 50 CENTS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1913

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1918

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K. N. W.

DEPARTMENT OF COMMERCE,
U. S. COAST AND GEODETIC SURVEY,
WASHINGTON, D. C., *July 1, 1913.*

This publication covers the coast from Cape Henry to Key West, and is based mainly upon the work of the United States Coast and Geodetic Survey, including the results of special examinations by a party on the Coast and Geodetic Survey steamer *Hydrographer* in 1912.

This volume covers the same territory formerly included in United States Coast Pilot, Part VII, from Chesapeake Bay Entrance to Key West, of which three editions were published, the first edition having been prepared by Lieut. Edwin H. Tillman, United States Navy, and Mr. John Ross.

The present volume has been prepared by Herbert C. Graves, assisted by E. Vance Miller and J. T. Watkins, nautical experts, in the office of J. J. Gilbert, inspector of hydrography and topography, Coast and Geodetic Survey.

Great courtesy has been shown by the United States engineers and local authorities in furnishing information for use in this publication.

The aids to navigation are corrected to July 1, 1913.

Navigators are requested to notify the Superintendent of the Coast and Geodetic Survey of any errors or omissions they may find in this publication, or of additional matter which they think should be inserted for the information of mariners.

O. H. TITTMANN,
Superintendent.

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NOTE.

The courses and bearings given in degrees are *true*, reading clockwise from 0° at north to 360°, and are followed by the equivalent *magnetic* value in points in parentheses. General directions, such as northeastward, west-southwestward, etc., are magnetic.

Distances are in *nautical miles*, and may be converted approximately to statute miles by adding 15 per cent to the distances given.

Currents are expressed in knots, which are nautical miles per hour.

Except where otherwise stated, all depths are at *mean low water*.

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NAVIGATIONAL AIDS AND THE USE OF CHARTS.

The Coast and Geodetic Survey is charged with the survey of the coasts, harbors, and tidal estuaries of the United States and its insular possessions and issues the following publications relating to these waters as guides to navigation: Charts, Coast Pilots, Tide Tables, a catalogue of these publications, and Notice to Mariners, the last named published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey.

CHARTS are corrected from information received to the date of issue, which is stamped in the lower left-hand corner. Subsequent changes relating to changes in aids, recently discovered dangers, wrecks, etc., must be procured from the Notice to Mariners. When the amount and importance of new material warrant it, a new edition of the chart is issued and the old edition called in from the agents and canceled; the date of the edition is given in the title or at the middle of the bottom of the chart.

The charts are various in character, according to the objects which they are designed to subserve. The most important distinctions are the following:

1. Sailing charts, mostly on a scale of approximately $\frac{1}{1,200,000}$, which exhibit the approaches to a large extent of coast, give the offshore soundings, and enable the navigator to identify his position as he approaches from the open sea.

2. General charts of the coast, on scales of $\frac{1}{400,000}$ and $\frac{1}{200,000}$, intended especially for coastwise navigation.

3. Coast charts, on a scale of $\frac{1}{80,000}$, by means of which the navigator is enabled to avail himself of the channels for entering the larger bays and harbors.

4. Harbor charts, on larger scales, intended to meet the needs of local navigation.

COAST PILOTS, relating to the surveyed waters of the United States, Porto Rico, and a part of Alaska, and Sailing Directions of the Philippine Islands, contain full nautical descriptions of the coast, harbors, dangers, and directions for coasting and entering harbors. Similar information relating to parts of Alaska and Hawaii is published in Coast Pilot Notes, for which no charge is made.

Coast Pilots are corrected for important information received to the date of issue, which is stamped on the correction sheets accompanying the volume. From time to time, as the material accumulates, supplements are issued, containing the more important corrections since the publication of the volume. The supplements are

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printed on one side of the paper only, so that they may be cut and pasted in the appropriate places in the volume. Supplements and other corrections for any volume can be furnished on application, provided the volume itself has not been superseded by a subsequent edition.

TIDE TABLES.—The Coast and Geodetic Survey Tide Tables are issued annually in advance of the year for which they are made, and contain the predicted time and height of the tides for each day in the year at the principal ports of the world, including the United States and its possessions. A table of tidal differences is given by means of which the tides at more than 3,000 intermediate ports may be obtained. Separate reprints from the general Tide Tables are issued for the Atlantic and Pacific coasts of the United States and its dependencies.

AGENCIES for the sale of the Charts, Coast Pilots, and Tide Tables of the Coast and Geodetic Survey are established in many ports of the United States and in some foreign ports. They can also be purchased in the office of the Coast and Geodetic Survey, Washington, D. C. If ordered by mail, prepayment is obligatory. Remittances should be made by postal money order or express order, payable to the "Assistant in charge of the office." Postage stamps, checks, and drafts can not be accepted. The sending of money in an unregistered letter is unsafe. Only catalogue numbers of charts need be mentioned. The catalogue of charts and other publications of the Survey can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey Office, Washington, D. C.

OTHER PUBLICATIONS.—Lists of Lights, Buoys, and other Daymarks of the United States, its insular possessions, and the Great Lakes, are published by the Bureau of Lighthouses. Notice to Mariners, relating to the same waters, is published weekly by the Bureau of Lighthouses and Coast and Geodetic Survey. These publications can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.

USE OF CHARTS.

ACCURACY OF CHART.—The value of a chart depends upon the character and accuracy of the survey on which it is based, and the larger the scale of the chart the more important do these become. In these respects the source from which the information has been compiled is a good guide.

This applies particularly to the charts of the Alaska Peninsula, Aleutian Islands, Arctic Ocean, and parts of Bering Sea and the Philippine Islands. The early Russian and Spanish surveys were not made with great accuracy, and until they are replaced by later surveys these charts must be used with caution.

With respect to these regions the fullness or scantiness of the soundings is another method of estimating the completeness of a chart. When the soundings are sparse or unevenly distributed it may be taken for granted that the survey was not in great detail.

A wide berth should therefore be given to every rocky shore or patch, and this rule should invariably be followed, viz, that instead of considering a coast to be clear unless it is shown to be foul, the contrary should be assumed.

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With respect to a well-surveyed coast only a fractional part of the soundings obtained are shown on the chart, a sufficient number being selected to clearly indicate the contour of the bottom. When the bottom is uneven the soundings will be found grouped closely together, and when the slopes are gradual fewer soundings are given. Each sounding represents an actual measure of depth and location at the time the survey was made.

Shores and shoals where sand and mud prevail, and especially bar harbors and the entrances of bays and rivers exposed to strong tidal currents and a heavy sea, are subject to continual change of a greater or less extent, and important ones may have taken place since the date of the last survey. In localities which are noted for frequent and radical changes, such as the entrance to a number of estuaries on the Atlantic, Gulf, and Pacific coasts, notes are printed on the charts calling attention to the fact.

It should also be remembered that in coral regions and where rocks abound it is always possible that a survey with lead and line, however detailed, may have failed to find every small obstruction. For these reasons when navigating such waters the customary sailing lines and channels should be followed, and those areas avoided where the irregular and sudden changes in depth indicate conditions which are associated with pinnacle rocks or coral heads.

Dredged Channels.—These are generally shown on the chart by two broken lines to represent the side limits of the improvement. Before completion of the project the depth given is that shown by the latest survey received from the engineer in charge. After completion the depth given is the one proposed to be maintained by redredging when necessary.

The actual depth of a completed channel may be greater than the charted depth shortly after dredging, and less when shoaling occurs as a result of storms or other causes. These changes are of too frequent occurrence and uncertain duration to chart. Therefore when a vessel's draft approximates the charted depth of a dredged channel, the latest information should be obtained before entering.

Danger Curves.—The curves of depth will be found useful in giving greater prominence to outlying dangers. It is a good plan to trace out with a colored pencil the curve next greater than the draft of the vessel using the chart, and regard this as a "danger curve," which is not to be crossed without precaution.

Isolated soundings shoaler than surrounding depths should be avoided, as there is always the possibility that the shoalest spot may not have been found.

Caution in Using Small-Scale Charts.—It is obvious that dangers to navigation can not be shown with the same amount of detail on small-scale charts as on those of larger scale, therefore in approaching the land or dangerous banks regard should be had to the scale of the chart used. A small error in laying down a position means only yards on a large-scale chart, whereas on a small scale the same amount of displacement means large fractions of a mile.

For the same reason, bearings to near objects should be used in preference to objects farther off, although the latter may be more prominent, as a small error in bearing or in laying it down on the chart has a greater effect in misplacing the position the longer the line to be drawn.

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DISTORTION OF PRINTED CHARTS.—The paper on which charts are printed has to be dampened. On drying, distortion takes place from the inequalities in the paper, which varies with the paper and the amount of the original dampening; but it is not sufficient to affect ordinary navigation. It must not, however, be expected that accurate series of angles taken to different points will always exactly agree, when carefully plotted upon the chart, especially if the lines to objects be long. The larger the chart the greater the amount of this distortion.

BUOYS.—Too much reliance should not be placed on buoys always maintaining their exact position, especially when in exposed positions; it is safer, when possible, to navigate by bearings or angles to fixed objects on shore and by the use of the lead.

Gas buoys and other unwatched lights can not be implicitly relied on; the light may be altogether extinguished, or, if intermittent, the apparatus may get out of order.

LIGHTS.—The distances given in the light lists and on the charts for the visibility of lights are computed for a height of 15 feet for the observer's eye. The table of distances of visibility due to height, published in the light list, affords a means of ascertaining the effect of a greater or less height of the eye. The glare of a powerful light is often seen far beyond the limit of visibility of the actual rays of the light, but this must not be confounded with the true range. Again, refraction may often cause a light to be seen farther than under ordinary circumstances.

When looking for a light the fact may be forgotten that from aloft the range of vision is increased. By noting a star immediately over the light a bearing may be afterwards obtained from the standard compass.

The actual power of a light should be considered when expecting to make it in thick weather. A weak light is easily obscured by haze, and no dependence can be placed on its being seen.

The power of a light can be estimated by its candlepower as given in the light lists and in some cases by noting how much its visibility in clear weather falls short of the range due to the height at which it is placed. Thus a light standing 200 feet above the sea and recorded as visible only 10 miles in clear weather is manifestly of little brilliancy, as its height would permit it to be seen over 20 miles if of sufficient power.

FOG SIGNALS.—Sound is conveyed in a very capricious way through the atmosphere. Apart from the wind, large areas of silence have been found in different directions and at different distances from the origin of the sound signal, even in clear weather. Therefore too much confidence should not be felt as to hearing a fog signal. The apparatus, moreover, for sounding the signal may require some time before it is in readiness to act. A fog often creeps imperceptibly toward the land and is not observed by those at a lighthouse until it is upon them, whereas a vessel may have been in it for many hours while approaching the land. In such a case no signal may be sounded. When sound travels against the wind it may be thrown upward; in such a case a man aloft might hear it when it is inaudible on deck. The conditions for hearing a signal will vary at the same station within short intervals of time; mariners must not, therefore, judge their distance from a fog signal by the force of the sound

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and must not assume that a signal is not sounding because they do not hear it.

Taken together, these facts should induce the utmost caution when nearing the land or danger in fog. The lead is generally the only safe guide and should be faithfully used.

SUBMARINE BELLS have an effective range of audibility greater than signals sounded in air, and a vessel equipped with receiving apparatus can determine the approximate bearing of the signal. These signals can be heard also on vessels not equipped with receiving apparatus by observers below the water line, but the bearing of the signal can not then be readily determined.

TIDES.—A knowledge of the tide, or vertical rise and fall of the water, is of great and direct importance whenever the depth at low water approximates or is less than the draft of the vessel and wherever docks are constructed so as to be entered and left near the time of high water. But under all conditions such knowledge may be of indirect use, as it often enables the mariner to estimate in advance whether at a given time and place the current will be running flood or ebb. In using the tables slack water should not be confounded with high or low tide nor a flood or ebb current with flood or ebb tide. In some localities the rise or fall may be at a stand while the current is at its maximum velocity.

THE TIDE TABLES published by the Coast and Geodetic Survey give the predicted times and heights of high and low waters for most of the principal ports of the world and tidal differences and constants for obtaining the tides at all important ports. If the height at any intermediate time is required, it may be obtained by the aid of tables 2, 2A, and 2B of the Tide Tables. The height at any time may be also approximately obtained by plotting the predicted times and heights and connecting them with a curve.

PLANE OF REFERENCE FOR SOUNDINGS ON CHARTS.—For the Atlantic coast of the United States and Porto Rico the plane of reference for soundings is the mean of all low waters; for the Pacific coast of the United States and Alaska, with the two exceptions noted below, and for the Hawaiian and Philippine Islands, it is the mean of the lower low waters. For Puget Sound, Wash., the plane of reference is 2 feet below mean lower low water, and for Wrangell Strait, Alaska, it is 3 feet below mean lower low water.

For the Atlantic coast of the Canal Zone, Panama, the plane of reference for soundings is mean low water, and for the Pacific coast of the same it is low-water springs.

For foreign charts many different planes of reference are in use, but that most frequently adopted is low-water springs.

It should be remembered that whatever plane of reference is used for a chart there may be times when the tide falls below it. When the plane is mean low water or mean lower low water there will generally be as many low waters or lower low waters below those planes as above them. Also the wind may at times cause the water to fall below the plane of reference.

TIDAL CURRENTS.—In navigating coasts where the tidal range is considerable special caution is necessary. It should be remembered that there are indrafts into all bays and bights, although the general set of the current is parallel to the shore.

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The turn of the tidal current offshore is seldom coincident with the time of high and low water on the shore.

At the entrance to most harbors without important tributaries or branches the current turns at or soon after the times of high and low water within. The diurnal inequality in the velocity of current will be proportionately but half as great as in the height of the tides. Hence, though the heights of the tide may be such as to cause the surface of the water to vary but little in level for 10 or 12 hours, the ebb and flow will be much more regular in occurrence.

A swift current often occurs in narrow openings between two bodies of water, because the water at a given instant may be at different levels.

Along most shores not seriously affected by bays, tidal rivers, etc., the current usually turns soon after high and low waters.

Where there is a large tidal basin with a narrow entrance, the strength of the current in the entrance may occur near the time of high and low water, and slack water at about half tide, outside.

The swiftest current in straight portions of tidal rivers is usually in the mid-channel, but in curved portions the strongest current is toward the outer edge of the curve.

Counter currents and eddies may occur near the shores of straits, especially in bights and near points.

TIDE RIPS AND SWIRLS occur in places where strong currents occur, caused by a change in the direction of the current, and especially over shoals or in places where the bottom is uneven. Such places should be avoided if exposed also to a heavy sea, especially with the wind opposing the current; when these conditions are at their worst the water is broken into heavy choppy seas from all directions, which board the vessel, and also make it difficult to keep control, owing to the baring of the propeller and rudder.

CURRENT ARROWS on charts show only the usual or mean direction of a tidal stream or current. It must not be assumed that the direction of the current will not vary from that indicated by the arrow. In the same manner, the velocity of the current constantly varies with circumstances, and the rate given on the chart is a mean value, corresponding to an average range of tide. At some stations but few observations have been made.

FIXING POSITION.—The most accurate method available to the navigator of fixing a position relative to the shore is by plotting with a protractor sextant angles between well-defined objects on the chart; this method, based on the "three-point problem" of geometry, should be in general use.

In many narrow waters, also, where the objects may yet be at some distance, as in coral harbors or narrow passages among mud banks, navigation by sextant and protractor is invaluable, as a true position can in general be obtained only by its means. Positions by bearings are too rough to depend upon, and a small error in either taking or plotting a bearing might under such circumstances put the ship ashore.

For its successful employment it is necessary: First, that the objects be well chosen; and, second, that the observer be skillful and rapid in his use of the sextant. The latter is only a matter of practice.

Near objects should be used either for bearings or angles for position in preference to distant ones, although the latter may be more prominent, as a small error in the bearing or angle or in laying it on the chart

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has a greater effect in misplacing the position the longer the line to be drawn.

On the other hand, distant objects should be used for direction because less affected by a small error or change of position.

The three-arm protractor consists of a graduated circle with one fixed and two movable radial arms. The zero of the graduation is at the fixed arm and by turning the movable arms each one can be set at any desired angle with reference to the fixed arm.

To plot a position, the two angles observed between the three selected objects are set on the instrument, which is then moved over the chart until the three beveled edges in case of a metal instrument, or the radial lines in the case of a transparent or celluloid instrument, pass respectively and simultaneously through the three objects. The center of the instrument will then mark the ship's position, which may be pricked on the chart or marked with a pencil point through the center hole.

The tracing-paper protractor, consisting of a graduated circle printed on tracing paper, can be used as a substitute for the brass or celluloid instrument. The paper protractor also permits the laying down for simultaneous trial of a number of angles in cases of fixing important positions. Plain tracing paper may also be used if there are any suitable means of laying off the angles.

The value of a determination depends greatly on the relative positions of the objects observed. If the position sought lies on the circle passing through the three objects it will be indeterminate, as it will plot all around the circle. An approach to this condition, which is called a revolver, must be avoided. In case of doubt select from the chart three objects nearly in a straight line, or with the middle object nearest the observer. Near objects are better than distant ones, and, in general, up to 90° the larger the angles the better, remembering always that large as well as small angles may plot on or near the circle and hence be worthless. If the objects are well situated, even very small angles will give for navigating purposes a fair position, when that obtained by bearings of the same objects would be of little value.

Accuracy requires that the two angles be simultaneous. If under way and there is but one observer, the angle that changes less rapidly may be observed both before and after the other angle and the proper value obtained by interpolation.

A single angle and a range give in general an excellent fix, easily obtained and plotted.

The Compass.—It is not intended that the use of the compass to fix the position should be given up; there are many circumstances in which it may be usefully employed, but errors more readily creep into a position so fixed. Where accuracy of position is desired, angles should invariably be used, such as the fixing of a rock or shoal, or of additions to a chart, as fresh soundings or new buildings. In such cases angles should be taken to several objects, the more the better; but five objects is a good number, as the four angles thus obtained prevent any errors.

When only two objects are visible, a sextant angle can be used to advantage with the compass bearings and a better fix obtained than by two bearings alone.

Doubling the Angle on the Bow.—The method of fixing by doubling the angle on the bow is invaluable. The ordinary form of

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it, the so-called "bow and beam bearing," the distance from the object at the latter position being the distance run between the times of taking the two bearings, gives the maximum of accuracy, and is an excellent fix for a departure, but does not insure safety, as the object observed and any dangers off it are abeam before the position is obtained.

By taking the bearings at two points and four points on the bow, a fair position is obtained before the object is passed, the distance of the latter at the second position being, as before, equal to the distance run in the interval, allowing for current. Taking afterwards the beam bearing gives, with slight additional trouble, the distance of the object when abeam; such beam bearings and distances, with the times, should be continuously recorded as fresh departures, the importance of which will be appreciated in cases of being suddenly shut in by fog.

A graphic solution of the problem for any two bearings of the same object is frequently used. The two bearings are drawn on the chart, and the course is then drawn by means of the parallel rulers so that the distance measured from the chart between the lines is equal to the distance made good by the vessel between the times of taking the bearings.

Danger Angle.—The utility of the danger angle in passing outlying rocks or dangers should not be forgotten. In employing the horizontal danger angle, however, charts compiled from early Russian and Spanish sources, referred to in a preceding paragraph, should not be used.

Soundings.—In thick weather, when near, or approaching the land or danger, soundings should be taken continuously and at regular intervals, and, with the character of the bottom, systematically recorded. By marking the soundings on tracing paper, according to the scale of the chart, along a line representing the track of the ship, and then moving the paper over the chart parallel with the course until the observed soundings agree with those of the chart, the ship's position will in general be quite well determined.

Sumner's Method.—Among astronomical methods of fixing a ship's position the great utility of Sumner's method should be well understood, and this method should be in constant use. The Sumner line—that is, the line drawn through the two positions obtained by working the chronometer observation for longitude with two assumed latitudes, or by drawing through the position obtained with one latitude a line at right angles to the bearing of the body as obtained from the azimuth tables—gives at times invaluable information, as the ship must be somewhere on that line, provided the chronometer is correct. If directed toward the coast, it marks the bearing of a definite point; if parallel with the coast, the distance of the latter is shown. Thus the direction of the line may often be usefully taken as a course. A sounding at the same time with the observation may often give an approximate position on the line. A very accurate position can be obtained by observing two or more stars at morning or evening twilight, at which time the horizon is well defined. The Sumner lines thus obtained will, if the bearings of the stars differ three points or more, give an excellent result. A star or planet at twilight and the sun afterwards or before may be combined; also two observations of the sun with sufficient interval to admit of a consid-

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erable change of bearing. In these cases one of the lines must be moved for the run of the ship. The moon is often visible during the day and in combination with the sun gives an excellent fix.

CHANGE OF VARIATION OF THE COMPASS.—The gradual change in the variation must not be forgotten in laying down positions by bearings on charts. The magnetic compasses placed on the charts for the purpose of facilitating plotting become in time slightly in error, and in some cases, such as with small scales, or when the lines are long, the displacement of position from neglect of this change may be of importance. The compasses are reengraved for every new edition if the error is appreciable. Means for determining the amount of this error are provided by printing the date of constructing the compass and the annual change in variation near its edge.

The change in the magnetic variation in passing along some parts of the coast of the United States is so rapid as to materially affect the course of a vessel unless given constant attention. This is particularly the case in New England and parts of Alaska, where the lines of equal magnetic variation are close together and show rapid changes in magnetic variation from place to place, as indicated by the large differences in variation given on neighboring compass roses.

LOCAL MAGNETIC DISTURBANCE.—The term "local magnetic disturbance" or "local attraction" has reference only to the effects on the compass of magnetic masses external to the ship. Observation shows that such disturbance of the compass in a ship afloat is experienced only in a few places.

Magnetic laws do not permit of the supposition that it is the visible land which causes such disturbance, because the effect of a magnetic force diminishes in such rapid proportion as the distance from it increases that it would require a local center of magnetic force of an amount absolutely unknown to affect a compass half a mile distant.

Such deflections of the compass are due to magnetic minerals in the bed of the sea under the ship, and when the water is shallow, and the force strong, the compass may be temporarily deflected when passing over such a spot, but the area of disturbance will be small, unless there are many centers near together.

The law which has hitherto been found to hold good as regards local magnetic disturbances is, that north of the magnetic equator the north end of the compass needle is attracted toward any center of disturbance; south of the magnetic equator it is repelled.

It is very desirable that whenever an area of local magnetic disturbance is noted, the position should be fixed, and the facts reported as far as they can be ascertained.

USE OF OIL FOR MODIFYING THE EFFECT OF BREAKING WAVES.—Many experiences of late years have shown that the utility of oil for this purpose is undoubted and the application simple.

The following may serve for the guidance of seamen, whose attention is called to the fact that a very small quantity of oil skillfully applied may prevent much damage both to ships (especially of the smaller classes) and to boats by modifying the action of breaking seas.

The principal facts as to the use of oil are as follows:

1. On free waves, i. e., waves in deep water, the effect is greatest.

2. In a surf, or waves breaking on a bar, where a mass of liquid is in actual motion in shallow water, the effect of the oil is uncertain,

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as nothing can prevent the larger waves from breaking under such circumstances, but even here it is of some service.

3. The heaviest and thickest oils are most effectual. Refined kerosene is of little use; crude petroleum is serviceable when nothing else is obtainable; but all animal and vegetable oils, such as waste oil from the engines, have great effect.

4. A small quantity of oil suffices, if applied in such a manner as to spread to windward.

5. It is useful in a ship or boat, either when running, or lying-to, or in wearing.

6. No experiences are related of its use when hoisting a boat at sea or in a seaway, but it is highly probable that much time would be saved and injury to the boat avoided by its use on such occasions.

7. In cold water the oil, being thickened by the lower temperature and not being able to spread freely, will have its effect much reduced. This will vary with the description of oil used.

8. For a ship at sea the best method of application appears to be to hang over the side, in such a manner as to be in the water, small canvas bags, capable of holding from 1 to 2 gallons of oil, the bags being pricked with a sail needle to facilitate leakage of the oil. The oil is also frequently distributed from canvas bags or oakum inserted in the closet bowls.

The positions of these bags should vary with the circumstances. Running before the wind, they should be hung on either bow—e. g., from the cathead—and allowed to tow in the water.

With the wind on the quarter the effect seems to be less than in any other position, as the oil goes astern while the waves come up on the quarter.

Lying-to, the weather bow, and another position farther aft, seem the best places from which to hang the bags, using sufficient line to permit them to draw to windward while the ship drifts.

9. Crossing a bar with a flood tide, to pour oil overboard and allow it to float in ahead of the boat, which would follow with a bag towing astern, would appear to be the best plan. As before remarked, under these circumstances the effect can not be so much trusted.

On a bar, with the ebb tide running, it would seem to be useless to try oil for the purpose of entering.

10. For boarding a wreck, it is recommended to pour oil overboard to windward of her before going alongside. The effect in this case must greatly depend upon the set of the current and the circumstances of the depth of water.

11. For a boat riding in bad weather from a sea anchor, it is recommended to fasten the bag to an endless line rove through a block on the sea anchor, by which means the oil can be diffused well ahead of the boat and the bag readily hauled on board for refilling, if necessary.

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UNITED STATES COAST PILOT.

ATLANTIC COAST—SECTION D.

CAPE HENRY TO KEY WEST.[1]

The information contained in this volume, Section D of the "United States Coast Pilot, Atlantic Coast," relates to the coast from Cape Henry to Key West, a distance of over 1,000 miles, embracing the coasts of a part of Virginia, North Carolina, South Carolina, Georgia, and Florida.

From Cape Henry to Cape Florida the general character of the coast is low and sandy, backed by woods, the highest land (63 feet) near the coast being Mount Cornelia, just northward of the entrance of St. Johns River. The principal harbors lie between Cape Lookout and St. Johns River, the stretches of the coast northward and southward of these limits being broken only by a number of unimportant inlets.

Between Winyah Bay and St. Johns River the shore is very broken, the harbors, inlets, and sounds being in many cases but little over 10 miles apart. This part of the coast has shoals which extend off from 3 to 8 miles. Cape Hatteras, Cape Lookout, Cape Fear, Cape Romain, and Cape Canaveral are distinguished for the distance to which dangerous shoals extend seaward from them. These shoals are generally sand, shifting to some extent with every heavy gale; with the strong currents which are found at times, they form the greatest danger for the navigator while passing along this coast.

From Cape Florida to Key West the coast is formed by a chain of small islands, known as Florida Keys, off and nearly parallel to which are the Florida Reefs. The harbors along this stretch of coast are Miami and Key West, and there are a few anchorages among the keys and reefs.

South of latitude 27° 24′ N., and lying at a least distance of 42 miles eastward of the coast of Florida, are Great and Little Bahama Banks and the Bahama Islands; and southward of the Florida Reefs, at a least distance of 78 miles, is the island of Cuba. North and west of these islands and skirting the coast of Florida are the

[1]Shown on the following sailing charts: 1001, deg. L.=3.7 inches, 1002, deg. L.=3.6 inches; **10, 11, 12, 13, 14, 15,** general charts of the coast, scale $\frac{1}{400,000}$; **1227, 138 to 169,** both inclusive, scale $\frac{1}{80,000}$, price of each $0.50; and a number of harbor charts, on a larger scale, as noted under the several headings. All charts referred to in footnotes are issued by the Coast and Geodetic Survey.

Coast and Geodetic Survey charts can be obtained from the agents. Facing this page is an index map, showing the location and limits of charts covering that part of the coast included in this volume. The catalogue of charts can be obtained free of charge on application at any of the sale agencies or to the Coast and Geodetic Survey, Washington, D. C.

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Straits of Florida, through which flow the waters of the Gulf Stream. The straits, in connection with the channels between the islands, form the northern approach and entrance to the Gulf of Mexico.

Harbors and ports.—The more important places, either commercially or as harbors of refuge, are Lookout Bight, Beaufort Harbor (N. C.), Cape Fear River, Winyah Bay, Charleston Harbor, Port Royal, Tybee Roads and Savannah River, Sapelo Sound, St. Simon Sound, Cumberland Sound, St. Johns River, and Key West.

Harbor entrances.—The entrance of every harbor on this stretch of the coast is more or less obstructed by a shifting sand bar over which the channel depth is changeable. The channels of the entrances to the larger and more important harbors are being improved by dredging, and in some cases by jetties which extend from both sides of the entrance seaward to deep water outside of the bars. At the improved entrances more dependence can be placed on the channel depths, as given in this volume, than on the bars of the harbors not under improvement. Masters of vessels bound to the harbors along this coast should, in cases where the depths given in this volume are approximately the same as the draft of their vessel, inquire of local pilots what draft is at the time being taken in and out over the bar.

On the bars not under improvement the buoys are moved from time to time to indicate the channel; but they are liable to be dragged out of position and can not always be immediately replaced, so that a stranger must use the greatest caution. A stranger should, if possible, select a rising tide for entering any of the harbors on this coast.

The tidal currents have considerable velocity in all of the entrances, and their direction is affected by the force and direction of the wind; sailing vessels entering the harbors and sounds require a fair working breeze during the ebb.

In easterly gales the sea breaks on most of the bars and no stranger should then attempt to enter such harbors without the assistance of a pilot.

System of buoyage.—In conformity with section 4678 of the Revised Statutes of the United States, the following order is observed in coloring and numbering buoys in United States waters, viz:

In approaching the channel, etc., from seaward, red buoys, with even numbers, will be found on the starboard side.

In approaching the channel, etc., from seaward, black buoys, with odd numbers, will be found on the port side.

Buoys painted with red and black horizontal stripes will be found on obstructions, with channel ways on either side of them and may be left on either hand in passing in.

Buoys painted with white and black perpendicular stripes will be found in mid-channel, and must be passed close-to to avoid danger.

All other distinguishing marks to buoys will be in addition to the foregoing, and may be employed to mark particular spots.

Perches, with balls, cages, etc., will, when placed on buoys, be at turning points, the color and number indicating on what side they shall be passed.

Nun buoys, properly colored and numbered, are usually placed on the starboard side, and can buoys on the port side of channels.

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Day beacons (except such as are on the sides of channels, which will be colored like buoys) are constructed and distinguished with special reference to each locality, and particularly in regard to the background upon which they are projected.

Aids to navigation.—The lighthouses and other aids to navigation are the principal guides, and mark the approach and channels to the important ports. The buoyage accords with the system adopted in United States waters. The principal coast lights are described in the text of this volume. For a complete description of all lighted aids see the Light List, Atlantic and Gulf Coasts of the United States, published by the Lighthouse Service, which can be obtained, free of charge, from the Division of Publications, Department of Commerce, Washington, D. C.

Pilots cruise off the entrances of the principal ports, while at some of the others they keep a lookout for vessels making the pilot signals outside the bar. Pilotage is compulsory for certain vessels entering from sea, but is not compulsory for the interior waters inside the inlets. Pilots for parts of the inside route are obtained at the larger cities and towns along the route. Pilot rates for the entrances are given in Appendix I; in general, the charge for piloting in interior waters is by special agreement with the pilot.

Towboats are stationed at Cape Fear River, Winyah Bay, Charleston Harbor, Savannah River, St. Simon Sound (Brunswick), Cumberland Sound (Fernandina), and St. Johns River.

Harbor masters are appointed for the principal ports, and they have charge of the anchorage and berthing of vessels in their respective harbors. For harbor masters' fees see Appendix I. The laws prohibit the dumping of ashes or other materials in the channels.

Navigation laws of the United States are published by the Bureau of Navigation, Department of Commerce, at intervals of four years, the present edition being that of 1911. A supplement is issued after every session of Congress. The volume and supplements can be obtained from the superintendent of documents, Government Printing Office, Washington, D. C., price $1 for the volume and 5 cents each for the supplements.

Rules of the Road.—International and inland "Rules to prevent collisions of vessels," lines within which the inland rules apply, and "Regulation of motor boats" are published by the Bureau of Navigation, Department of Commerce, in Department Circular No. 230, June 27, 1911.

Pilot Rules for certain inland waters of the Atlantic and Pacific coasts and of the coast of the Gulf of Mexico are published by the Steamboat-Inspection Service, in Form 804.

Copies of these pamphlets are furnished by the officers of the Steamboat-Inspection Service, and can also be had from the Division of Publications, Department of Commerce, Washington, D. C.

National quarantine.—Quarantine for all ports within the limits of this volume are enforced in accordance with the regulations of the United States Public Health Service. Quarantine regulations will be found at the stations of the service and at American consulates, and will be furnished to vessels upon application, either by officers of the service or by the bureau in Washington, D. C. Every vessel should be

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provided with the quarantine regulations. The following are the quarantine stations within the limits covered by this volume:

Cape Charles, Va.; address Quarantine, Fort Monroe, Va.
Washington, N. C.
Newbern, N. C.
Cape Fear (Southport), N. C.
Charleston, S. C.
Georgetown (South Island), S. C.
Beaufort, S. C.
Port Royal, S. C.
Savannah, Ga.
South Atlantic (Blackbeard Island), Ga.; telegraphic address Darien, post office address Inverness.
Brunswick, Ga.
Cumberland Sound (Fernandina), Fla.
St. Johns River (Mayport), Fla.
Biscayne Bay (Miami), Fla.
Key West, Fla.

Marine hospital.—Information as to relief furnished seamen will be found in the regulations of the United States Public Health Service, which can be consulted at all stations of the service. Such stations are located at ports of any importance, and if not in charge of a service officer relief will be provided by collectors of customs upon application.

The following stations are in charge of a service officer:

Norfolk, Va.
Washington, N. C.
Newbern, N. C.
Beaufort, N. C.
Wilmington (marine hospital), N. C.
Georgetown, S. C.
Charleston, S. C.
Savannah (marine hospital), Ga.
Brunswick, Ga.
Fernandina, Fla.
Jacksonville, Fla.
Key West (marine hospital), Fla.

Supplies.—Coal can be obtained at Newport News, Norfolk, Beaufort (N. C.), Wilmington, Charleston, Port Royal, Savannah, Jacksonville, and Key West. Water, provisions, ship chandler's stores, and gasoline can be had at the above cities and at all towns.

Repairs.—Newport News, Norfolk, Savannah, and Jacksonville are the principal places at which extensive repairs to the hulls of vessels and machinery of steamers can be made. There are facilities for repairs at Elizabeth City, Washington, Newbern, Wilmington, Georgetown, Charleston, Brunswick, and Key West. Minor repairs can be made and small craft can be hauled out at several other places.

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LARGEST DRY DOCKS AND MARINE RAILWAYS.

Port.	Name.	Length over blocks.	Depth on sill at high water.	Capacity.
		Feet.	*Feet.*	*Tons.*
Newport News, Va.	Dry dock	804	30	.....
Norfolk, Va.	Dry dock (Gov't)	478	34	.....
	Railway	225	10; 16½	1,500
Elizabeth City, N. C.	....do	205	5; 10	800
Washington, N. C.	....do	155	.....	600
Newbern, N. C.	....do	110	.....	500
Wilmington, N. C.	....do	175	9; 18	1,200
Georgetown, S. C.	....do	110	5; 9	.....
Charleston, S. C.	Dry dock (Gov't)	503	32½	.....
	Railway	170	7; 13	700
Savannah, Ga.	....do	250	9; 18	1,000
Brunswick, Ga.	....do	.....	7; 12	400
Jacksonville, Fla.	Floating dock	330	20	4,500
	Railway	210	9	1,200
Key West	....do	180	10; 16	1,000

Fog.—The percentage of fog is highest from March to June, reaching a maximum of 30 per cent of days with fog near the mouth of Chesapeake Bay in June. This percentage decreases to 10 at Hatteras, and fog seldom occurs south of that point.

Prevailing winds.—The winds are westerly north of the thirty-fifth parallel, except in September and October when they are northeasterly along the entire coast. The westerly winds extend to the thirtieth parallel from December to April, inclusive. Easterly winds prevail along the Florida coast. At Key West they are northeasterly, except during the summer months, when they are southeasterly.

Northers.—In the winter months heavy northers occur in the vicinity of the Straits of Florida. They blow generally from northwest to north, hauling, as a rule, northward and eastward, and rarely backing. Their approach is nearly always heralded by a heavy bank of clouds in the northwest, preceded by light airs from the contrary direction, and accompanied by a falling barometer; they commence with a violent squall, gradually settling to a fresh gale. Vessels caught in the narrower parts of the straits in these gales are subject to a most trying sea.

Southeast gales also occur at intervals during the winter months in the vicinity of the Straits of Florida. They usually commence to blow at about ENE., freshening rapidly with a falling barometer and rising thermometer, and, hauling southward and eastward, obtain their greatest force at about southeast.

Storm warnings are displayed by the United States Weather Bureau on the coasts of the United States and the Great Lakes.

Small craft warning.—A red pennant indicates that moderately strong winds are expected.

Storm warning.—A red flag with a black center indicates that a storm of marked violence is expected.

The pennant displayed with the flag indicates the direction of the wind—white, westerly; red, easterly. The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below from the southerly quadrants.

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By night a red light indicates easterly winds, and a white light below a red light, westerly winds.

Hurricane warning.—Two red flags with black centers, displayed one above the other, indicate the expected approach of a tropical hurricane, or of one of those extremely severe and dangerous storms which occasionally move across the Great Lakes and northern Atlantic coast. These warnings are displayed at all stations on the Atlantic and Gulf coasts of the United States and on the following islands in the Atlantic: Jamaica, Santo Domingo, Turks Island, Bermuda, Haiti, Curacao, Porto Rico, St. Kitts, Dominica, Barbados, Trinidad, and Cuba. Neither small craft nor hurricane warnings are displayed at night.

The following are the storm warning display stations within the limits covered by this volume:

VIRGINIA:
- *Cape Henry.
- Fort Monroe.

NORTH CAROLINA:
- Beaufort.
- Columbia.
- Diamond Shoal light vessel.
- Edenton.
- Elizabeth City.
- *Hatteras.
- *Manteo.
- Morehead City.
- Newbern.
- Oak Island life-saving station.
- Southport.
- Washington.
- *Wilmington.

SOUTH CAROLINA:
- *Charleston.
- Charleston light vessel.
- Georgetown.
- Moultrieville.
- North Island.
- South Island.
- Youngs Island.

GEORGIA:
- Brunswick.
- Darien.

GEORGIA—Continued.
- *Savannah.
- Thunderbolt.
- Tybee.

FLORIDA:
- Cocoa.
- Cummer Mill.
- Daytona.
- Eau Gallie.
- Fernandina.
- Fort Pierce.
- *Jacksonville.
- Jupiter.
- *Key West.
- Key West, corner Caroline and Elizabeth Streets.
- Key West, No. 611 Front Street.
- Mayport.
- Melbourne.
- Miami.
- New Smyrna.
- Palmetto.
- St. Augustine.
- Sand Key.
- Stuart.
- Titusville.
- *West Palm Beach.

Note.—The Weather Bureau stations at Cape Henry, Va., and Sand Key, Fla., are equipped for day and night communication with passing vessels. The International Code is used by day and the Morse Code, flash-light, by night. Messages to or from vessels will be forwarded to destination.

WEST INDIA HURRICANES.

These are cyclonic storms with a center of lowest barometer, around which the wind blows in a more or less circular course (spirally) in a direction contrary to the hands of a watch. At the same time the storm field advances on a straight or curved

* At these stations barometers will be compared with standards.

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track, sometimes with great velocity, and sometimes not more than a few miles an hour, occasionally appearing to come to a pause in its onward movements. The estimated velocity on the Atlantic coast between Hatteras and the island of Cuba is 5 to 15 miles per hour. They cover simultaneously an approximately circular area from 150 to 500 miles in diameter. At the center, the area of lowest barometer, which is from 10 to 20 miles in diameter, comparative calm prevails; the seas within this center are violent and confused, and combined with the sudden shifts of wind which are encountered as the vessel passes through the center, make this the most dangerous part of the hurricane and the one to be avoided.

Hurricanes form eastward of the Windward Islands or in the Carribbean Sea, and take a westerly or northwesterly course. Some curve gradually northward, passing north of the island of Cuba and northeasterly along and eastward of the Atlantic coast of the United States. Others pass over or southward of Cuba and enter the Gulf of Mexico, and while in the Gulf usually curve northward or northeastward so as to strike the coast somewhere between Tampa, Fla., and the Rio Grande. Tracks of hurricanes are shown on meteorological and pilot charts of the North Atlantic Ocean, published monthly by the United States Weather Bureau and Hydrographic Office, respectively.

The months during which hurricanes are usually encountered are June to November, the months of their greatest frequency are August, September, and October. During these months mariners should be on the watch for indications of a hurricane, and should frequently and carefully observe and record the barometer.

Signs of approach.—First, a long heavy swell, a slight rise followed by a continuous fall of the barometer; second, a strong gusty wind from some northerly point (northeast, north, or northwest), blowing with increasing force; and third, a rough, increasing sea. If one or more of these signs be wanting there is little cause for anticipating a hurricane.

The approach of a hurricane is usually indicated by a long heavy swell, propagated to a great distance two or three days in advance, where there is no intervening land to interrupt it, and which comes from the direction in which the storm is approaching.

One of the earliest signs of a hurricane are high cirrus clouds which converge toward a point on the horizon that indicates the direction of the center of the storm. The snow-white fibrous mare's tails appear when the center of the storm is about 300 or 400 miles distant.

As the storm center approaches, the barometer continues to fall, the velocity of the wind increases and blows in heavy squalls, and the changes in its direction become more rapid. Rain in showers accompanies the squalls, and when closer to the center the rain is continuous and attended by furious gusts of wind; the air is frequently thick with rain and spume drift, making objects invisible at a short distance. A vessel on a line of the hurricane's advance will experience the above disturbances, except that as the center approaches, the wind will remain from the same direction, or nearly so, until the vessel is close to or in the center.

Distance from center.—The distance from the center of a hurricane can only be estimated from a consideration of the height of the barometer and the rapidity of its

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fall, and the velocity of the wind and rapidity of its change in direction. If the barometer falls slowly and the wind increases gradually it may be reasonably supposed that the center is distant; with a rapidly falling barometer and increasing winds the center may be supposed to be approaching dangerously near.

Practical rules.—When there are indications of a hurricane, vessels should remain in port or seek one if possible, carefully observing and recording the changes in barometer and wind and taking every precaution to avert damage by striking light spars, strengthening moorings, and if a steamer preparing steam to assist the moorings. In the ports of the Southern States hurricanes are generally accompanied by very high tides, and vessels may be endangered by overriding the wharf where lying if the position is at all exposed.

Vessels in the Straits of Florida may not have the sea room to maneuver so as to avoid the storm track, and should use every endeavor to make a harbor or stand out of the straits to obtain sea room. Vessels unable to reach port and having sea room to maneuver should observe the following rules:

When there are indications of a hurricane near, sailing vessels should heave to on the starboard tack and steamers remain stationary and carefully observe and record the changes in wind and barometer so as to find the bearing of the center and ascertain by the shift of wind in which semicircle the vessel is situated. Much will often depend on heaving to in time.

Bearings of center.—Facing the wind the storm center will be 8 to 12 points to the right; when the storm is distant it will be from 10 to 12 points, and when the barometer has fallen five or six tenths it will be about 8 points.

A line drawn through the center of a hurricane in the direction in which it is moving is called the axis or line of progression, and looking in the direction in which it is traveling the semicircle on either side of the axis is called, respectively, the right-hand, or dangerous, semicircle, and the left-hand, or navigable, semicircle.

To find in which semicircle the vessel is situated: If the wind shifts to the right, the vessel will be in the right-hand, or dangerous, semicircle, with regard to the direction in which the storm is traveling, in which case the vessel should be kept on the starboard tack and increase her distance from the center.

If the wind shifts to the left, the vessel will be in the left, or safe, semicircle. The helm should be put up and the vessel run with the wind on the starboard quarter, preserving the compass course, if possible, until the barometer rises, when the vessel may be hove to on the port tack. Or if there is not sea room to run, the vessel can be put on the port tack at once.

Should the wind remain steady and the barometer continue to fall, the vessel is in the path of the storm and should run with the wind on the starboard quarter into the safe semicircle.

In all cases act so as to increase as soon as possible the distance from the center, bearing in mind that the whole storm field is advancing.

In receding from the center of a hurricane the barometer will rise and the wind and sea subside.

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RADIO STATIONS.

The United States naval coastwise radio stations and all ships of the United States Navy equipped with radio apparatus are open for commercial business. Information concerning regulations, rates, and the commercial work of the stations may be obtained by addressing the Superintendent, Naval Radio Service, Radio, Va. Hydrographic information, weather reports, storm warnings, and noon time signals are sent out from the stations for the benefit of shipping.

Time signals.—In connection with the service over the land telegraph lines, time signals by radio are sent daily, Sundays and holidays excepted, from the United States naval coastwise radio stations, at noon of the seventy-fifth meridian time on the Atlantic coast, and at noon of the one hundred and twentieth meridian time on the Pacific coast. The signals begin at 11.55 and continue for 5 minutes. During this interval every tick of the clock is transmitted except the twenty-ninth second of each minute, the last 5 seconds of each of the first 4 minutes, and finally the last 10 seconds of the last minute. The noon signal is a longer contact after this long break.

A list of the radio stations of the world, including shore stations, merchant vessels, revenue cutters, and vessels of the United States Navy, can be obtained from the superintendent of documents, Government Printing Office, Washington, D. C., price $0.15. Changes or additions to the stations or in the regulations are published in Hydrographic Office Notice to Mariners issued weekly. The following is a list of the United States naval coastwise radio stations covered by this volume, and their call letters, corrected to January 1, 1912:

N A M.....Norfolk Navy Yard, Va.
N L B.....Diamond Shoals lightship.
N A N.....Beaufort, N. C.
N L C.....Frying Pan Shoals lightship.
N A O.....Charleston Navy Yard, S. C.
N A P.....St. Augustine, Fla.
N A Q.....Jupiter, Fla.
N A R.....Key West Navy Yard, Fla.

The following are commercial stations not operated by the Navy Department:

N F.....Norfolk, Va.
M S Y.....Virginia Beach, Va.
H A.....Cape Hatteras.
S V.....Savannah, Ga.
M S F.....Fernandina, Fla.
J X.....Jacksonville, Fla.
M B S.....Palm Beach, Fla.
K Y.....Knights Key, Fla.

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UNITED STATES LIFE-SAVING STATIONS.

Life-saving stations and houses of refuge are maintained at the places named in the following table. The stations are manned annually from August 1 to May 31, and are supplied with boats, wreck guns, beach apparatus, and all other appliances for affording assistance in case of shipwreck. Instructions to enable mariners to avail themselves fully of the assistance thus afforded will be sent free of charge upon application to the Life-Saving Service, Washington, D. C.

The life-saving stations are provided with the International Code of Signals. Where telephone or telegraph facilities are available, requests for a tug or revenue cutter will be received and promptly forwarded.

The houses of refuge on the coast of Florida are in charge of a keeper, and are supplied with boats, provisions, and restoratives.

Signals.—The following signals have been adopted by the Life-Saving Service:

Upon the discovery of a wreck by night, the life-saving force will burn a red pyrotechnic light or a red rocket to signify—"You are seen; assistance will be given as soon as possible."

A red flag waved on shore by day, or a red light, red rocket, or red Roman candle displayed by night, will signify—"Haul away."

A white flag waved on shore by day, or a white light slowly swung back and forth, or a white rocket, or white Roman candle fired by night will signify—"Slack away."

Two flags, a white and a red, waved at the same time on shore by day, or two lights, a white and a red, slowly swung at the same time, or a blue pyrotechnic light burned by night, will signify—"Do not attempt to land in your own boats. It is impossible."

A man on shore beckoning by day, or two torches burning near together by night, will signify—"This is the best place to land."

Any of these signals may be answered from the vessels as follows: In the daytime, by waving a flag, a handkerchief, a hat, or even the hand; at night, by firing a rocket, a blue light, or a gun, or by showing a light over the ship's gunwale for a short time, and then concealing it.

Cautions.—Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of the stations, to remain on board until assistance arrives, and under no circumstances should they attempt to land through the surf in their own boats, until the last hope of assistance from the shore has vanished. Often when comparatively smooth at sea a dangerous surf is running which is not perceptible 400 yards offshore, and the surf when viewed from a vessel never appears as dangerous as it is. Many lives have been lost unnecessarily by the crews of stranded vessels being thus deceived and attempting to land in the ship's boats.

The difficulties of rescue by operations from the shore are greatly increased in cases where the anchors are let go after entering the breakers, as is frequently done, and the chances of saving life correspondingly lessened.

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Name of station.	State.	Locality.
Cape Henry	Va.	¾ mile southeast of lighthouse.
Virginia Beach	Va.	5 miles south of Cape Henry Light.
Dam Neck Mills	Va.	9 miles south of Cape Henry Light.
Little Island	Va.	On beach abreast of North Bay.
False Cape	Va.	On beach abreast of Back Bay.
Wash Woods	N. C.	On beach abreast of Knotts Island.
Penneys Hill	N. C.	5 miles north of Currituck Beach Light.
Currituck Beach	N. C.	¾ mile north of Currituck Beach Light.
Poyners Hill	N. C.	6 miles south of Currituck Beach Light.
Caffeys Inlet	N. C.	9½ miles south of Currituck Beach Light.
Paul Gamiels Hill	N. C.	4½ miles north of Kitty Hawk.
Kitty Hawk	N. C.	On beach abreast north end of Kitty Hawk Bay.
Kill Devil Hills	N. C.	4 miles south of Kitty Hawk.
Nags Head	N. C.	8 miles north of Oregon Inlet.
Bodie Island	N. C.	¾ mile northeast of Bodie Island Light.
Oregon Inlet	N. C.	½ mile south of Oregon Inlet.
Pea Island	N. C.	2 miles north of New Inlet.
New Inlet	N. C.	½ mile south of New Inlet.
Chicamacomico	N. C.	4½ miles south of New Inlet.
Gull Shoal	N. C.	10 miles south of New Inlet.
Little Kinnakeet	N. C.	10 miles north of Cape Hatteras Light.
Big Kinnakeet	N. C.	5 miles north of Cape Hatteras Light.
Cape Hatteras	N. C.	1 mile south of the lighthouse.
Creeds Hill	N. C.	3½ miles west of Cape Hatteras Light.
Durants	N. C.	2½ miles east of Hatteras Inlet.
Hatteras Inlet	N. C.	1¼ miles west of Hatteras Inlet.
Ocracoke	N. C.	2½ miles northeast of Ocracoke Inlet.
Portsmouth	N. C.	Northeast end of Portsmouth Island.
Core Bank	N. C.	Halfway between Ocracoke Inlet and Cape Lookout.
Cape Lookout	N. C.	1½ miles south of the lighthouse.
Fort Macon	N. C.	Beaufort entrance, ¼ mile north of fort.
Bogue Inlet	N. C.	½ mile east of inlet.
Cape Fear	N. C.	On Smith Island, Cape Fear.
Oak Island	N. C.	West side mouth of Cape Fear River.
Sullivans Island	S. C.	At Moultrieville, at north end of harbor jetty.
Bulow‡	Fla.	17½ miles south of Matanzas Inlet.
Mosquito Lagoon‡	Fla.	On beach outside the lagoon.
Chester Shoal‡	Fla.	9½ miles north of Cape Canaveral.
Bethel Creek‡	Fla.	14 miles north of Indian River Inlet.
Indian River Inlet‡	Fla.	South side of inlet.
Gilberts Bar‡	Fla.	St. Lucie Rocks, 2 miles north of Gilberts Bar Inlet.
Fort Lauderdale‡	Fla.	3½ miles north of New River Inlet.
Biscayne Bay‡	Fla.	5 miles north of Norris Cut.

‡ House of refuge.

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VARIATION OF THE COMPASS.

The magnetic variation for 1915, and annual increase or decrease at points mentioned, are as follows:

Locality.	Variation.	Annual increase or decrease.
Off Cape Henry (10 miles)	5½° W.	Increase, 4′.
Off Cape Hatteras (12 miles)	5¼° W.	Do.
Off Cape Lookout (15 miles)	4° W.	Do.
Off Cape Fear (15 miles)	3° W.	Increase, 3′.
Off Charleston Entrance	1° W.	Do.
Off Savannah (on bar)	¼° W.	Increase, 2.′
On Doboy Sound bar	¼° E.	Decrease, 2′.
St. Johns River (outside jetties)	½° E.	Do.
Off Cape Canaveral (12 miles)	½° E.	Do.
At Fowey Rocks light	1¼° E.	Decrease, 1′.
At Alligator Reef light	1¾° E.	Do.
At Sombrero Key light	2° E.	No change.
At Sand Key light	2½° E.	Do.
At Rebecca Shoal light	2¾° E.	Do.
Hole in the Wall (Bahamas)	½° W.	Increase, 3′.
At Great Isaac light (Bahamas)	½° E.	Decrease, 2′.
On Salt Key Bank (N. of Cuba)	1½° E.	Decrease, 1′.
Middle of Albemarle Sound (off Bull Bay)	5° W.	Increase, 4′.
Middle of Croatan Sound	5¼° W.	Do.
Middle of Pamlico Sound (N. of Ocracoke)	4½° W.	Do.

TIDES.[1]

Locality.	Lunitidal intervals.[2]				Mean range.
	High water.		Low water.		
	h.	m.	h.	m.	Feet.
On Hatteras Shoals	6	25	0	06	3.6
Lookout Bight	6	29	0	20	3.7
Cape Fear River, Southport	7	30	1	25	4.4
Winyah Bay, Georgetown light	7	37	1	52	3.5
Charleston, Fort Sumter	7	17	1	00	5.0
Tybee lighthouse	7	11	1	05	6.8
St. Simon Sound lighthouse	7	30	1	27	6.4
Fernandina, Dade Street	8	00	1	42	6.0
St. Johns River, Mayport	7	38	1	39	4.2
Cape Canaveral	8	00	1	52	5.0
Cape Florida Anchorage	8	24	2	29	1.7
Turtle Harbor, Florida Reefs	8	21	2	08	2.1
Key West Harbor	9	20	2	36	1.2
Tortugas	9	44	3	21	1.1

[1] Tide tables for the Atlantic coast of the United States, published annually by the Coast and Geodetic Survey, predicting the times and heights of tides for every day of the year, at all the principal ports, can be obtained from the agents; price, $0.15.

[2] The mean lunitidal interval for high water or for low water is the average time from the meridian transit of the moon to the next following high or low water, respectively; it is also called the corrected establishment.

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CURRENTS, CAPE HENRY TO KEY WEST.

Current observations have been made at Diamond Shoal light vessel for parts of three years, and at the other light vessels on the South Atlantic coast for about three months during the summer of 1912, from which the following statement is deduced:

Tidal currents with an average velocity of 0.5 knot at strength occur at all the light vessels, the direction of the flood and ebb at strength being directly on and off shore. The tidal currents are rotary, revolving clockwise, with minimum velocities 3 hours after the strength of the flood and ebb in a direction at right angles to that at the time of strength.

At all of the light vessels there was, superimposed on the tidal currents, a *permanent drift*, setting northeastward with the trend of the coast, and deflected somewhat by the shoals, averaging 0.7 knot at Diamond Shoal, 0.6 knot at Cape Lookout Shoals, 0.4 knot at Frying Pan Shoals, 0.2 knot at Charleston and Martins Industry, and 0.1 knot at Brunswick. From our present information the indications are that, except during northerly and northeasterly winds, a current of about 0.5 knot, setting northeastward with the trend of the coast, may be expected outside the 10-fathom curve as far north as Cape Hatteras, and that it increases offshore toward the axis of the Gulf Stream.

Wind currents.—Strong currents set with the wind along the coast in northeasterly and southerly gales, reversing or greatly accelerating the normal currents. Their strength and set depend on the direction, strength, and duration of the gale. The greatest observed velocities at the light vessels are, Diamond Shoal 4 knots, Cape Lookout Shoals 3.5 knots, Frying Pan Shoals 2 knots, Charleston 1.5 knots, Martins Industry 2 knots, and Brunswick 1.5 knots; except at Diamond Shoal, however, these results are for the three summer months of one year only.

The following is a more detailed statement of the observations at each light vessel:

Diamond Shoal light vessel.—The tidal currents have a mean velocity of 0.5 knot at strength, the flood in a north-northwesterly direction and the ebb south-southeasterly.

A prevailing current averaging 0.7 knot in a northeasterly direction was found throughout the year.

The maximum velocities observed due to winds occurred in February, March, and April, when the southwesterly and northeasterly currents attain velocities of 2 and 4 knots, respectively. During August, September, and October the maximum velocities in these directions are reduced to 1 and 2 knots, respectively. Wind velocities of 15 to 30 miles generally produce currents of 1 to 2 knots, to

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which must be applied the permanent set, adding it to the effect of southwest winds and subtracting it from the effect of northeast winds.

From May to August 70 per cent of the observations showed northeasterly currents, 10 per cent southwesterly and variable currents (mostly light), and 20 per cent slack currents, the two last being due to moderate winds not southerly or southwesterly. From September to April about 55 per cent of the observations showed northeasterly currents, 25 per cent southwesterly and variable currents, and 20 per cent slack currents. The only currents with large velocities were northeasterly and southwesterly, the average maximum velocity in a northeasterly direction being about double that in a southwesterly direction.

Cape Lookout Shoals light vessel.—The tidal currents are revolving, the strength of the flood and ebb having a velocity of 0.4 knot, and occurring 1⅔ hours after low and high water, respectively, at Charleston. The direction of the flood at strength is 273° true and the ebb opposite; 3 hours after the strength of the flood and ebb, the tidal current has its least velocity of 0.15 knot in a northerly and southerly direction, respectively.

A prevailing current was observed of 0.39 knot during June and 0.74 knot during July and August, average 0.6 knot for the three months, in an 88° true direction. The combination of this and the tidal current gives a set of 1 knot easterly during the strength of the ebb, and 0.2 knot easterly during the strength of the flood.

These normal movements are affected by the winds; wind velocities of 15 to 30 miles produce currents of about 1 to 2 knots, setting approximately fair with the winds. This wind current must be combined with the preceding currents in making allowance for set.

Frying Pan Shoals light vessel.—The tidal currents are revolving, the strength of the flood and ebb having a velocity of 0.5 knot, and occurring 2 hours after low and high water, respectively, at Charleston. The direction of the flood at strength is 294° true and the ebb opposite; 3 hours after the strength of the flood and ebb, the tidal current has its least velocity of 0.26 knot north-northeasterly and south-southwesterly, respectively.

A prevailing current was observed of 0.4 knot in a 90° true direction. The combination of this and the tidal currents gives a set of 0.9 knot easterly during the strength of the ebb, and slack water at the strength of the flood.

These normal movements are affected by the winds; wind velocities of 10 to 30 miles produce currents of about 0.5 to 1.5 knots, setting approximately fair with the wind. This wind current must be combined with the preceding currents in making allowance for set.

Charleston light vessel.—The tidal currents are revolving, the strength of the flood and ebb having a velocity of 0.4 knot, and occur-

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ring 2 and 2¼ hours, respectively, after low and high water at Charleston. The direction of the flood at strength is 278° true and the ebb opposite; 3 hours after the strength of the flood and ebb, the tidal current has its least velocity of 0.2 knot northward and southward, respectively.

A prevailing current was observed of 0.17 knot in a northeasterly direction.

These normal movements are affected by the winds; wind velocities of 10 to 25 miles produce currents of about 0.5 to 1.0 knot, setting approximately fair with the wind. This wind current must be combined with the preceding currents in making allowance for set.

Martins Industry light vessel.—The tidal currents are revolving, the strength of the flood and ebb having a velocity of 0.5 knot, and occurring about 2¾ hours after low and high water, respectively, at Charleston. The direction of the flood at strength is 284° true, and the ebb opposite; 3 hours after the strength of the flood and ebb the tidal current has its least velocity of 0.13 knot northward and southward, respectively.

A prevailing current was observed of 0.23 knot in a 52° true direction.

These normal movements are affected by the winds; wind velocities of 15 to 30 miles produce currents of about 1 to 2 knots, setting approximately fair with the wind. This wind current must be combined with the preceding currents in making allowance for set.

Brunswick light vessel.—The tidal currents are revolving, the strength of the flood and ebb having a velocity of 0.5 knot, and occurring about 3¾ hours after low and high water, respectively, at Charleston. The direction of the flood at strength is 296° true, and the ebb opposite; 3 hours after the strength of the flood and ebb the tidal current has its least velocity of 0.13 knot north-northeastward and south-southwestward, respectively.

A prevailing current was observed of 0.13 knot in a 34° true direction.

These normal movements are affected by the winds; wind velocities of 10 to 20 miles produce currents of about 0.5 to 1 knot, setting approximately fair with the wind.

The **Gulf Stream** sets eastward and northward through the Straits of Florida, and after passing between Fowey Rocks and Little Bahama Bank it continues for some distance northward and then northeastward, its axis following the general direction of the 100-fathom curve, and from 10 to 20 miles eastward of it.

Passing through the Straits of Florida, the axis of the stream off Habana is nearest the southern edge of the current prism, but after making the bend between Salt Key Bank and Florida Reefs the axis

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is from 4¼ to 11½ miles outside the 100-fathom curve on the west side. There is another body of water northward of the West India Islands, which, driven by the trade winds, is moving westward. This is a slow current, but when it joins the Gulf Stream proper off the southern Atlantic coast of the United States it materially adds to the latter on its way toward the northern seas.

The width of the Gulf Stream off Cape Hatteras is about the same as when it leaves the Straits of Florida. It is, however, liable to more fluctuations in direction, particularly along the edges; and in its progress eastward, by the time the Newfoundland banks are reached, it is probable that these fluctuations entirely obliterate the Stream as a body distinguishable from its mate which has come by the outside passage from the trade region. In these latitudes, however (about 40° N.), the whole surface is slowly moving eastward, driven by the prevailing westerly winds. Approaching the shore of Europe it meets the obstruction of the continent and escapes laterally, one branch southward from the Azores toward the coast of Africa, the other branch into the Arctic.

The investigations of the Gulf Stream indicate that there is no way of utilizing the thermometer to determine with certainty the direction of the current.

A steamer bound from Cape Hatteras to Habana or the Gulf ports crosses the Stream off Cape Hatteras. A fair allowance to make in crossing the Stream is 1½ knots in a northeasterly direction for a distance of 40 miles from the 100-fathom curve. In the run from the southern edge of the stream to Matanilla Shoal no allowance for current can be given.

Crossing the Gulf Stream at Jupiter or Fowey Rocks an average allowance of 2¼ knots in a northerly direction should be made for the set of the current. The weakest current will be experienced about 3 hours before the transit of the moon.

Crossing the stream from Habana, a fair allowance for the average current between 100-fathom curves is 1.1 knots in an east-northeasterly direction.

In the Straits of Florida the velocity of the stream is affected by the winds, by differences in barometric pressure inside the Gulf of Mexico and outside, and by the tides. The first two causes produce the largest changes, and are difficult, if not impossible, to estimate. The semidiurnal effect of the tides on the stream amounts to about 0.5 knot, the maximum current of the Gulf Stream occurring 3 hours after the moon's meridian transit (upper or lower), and the minimum current 3 hours before the moon's transit. Outside of the Straits of Florida the velocity of the stream is affected principally by the winds.

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The following is the mean position of the axis of the Gulf Stream, or the point where the greatest velocity may be found:

	Miles.
East of Contoy Island, Yucatan	35
North of Habana	25
East of Fowey Rocks	11
East of Jupiter Inlet lighthouse	19
Southeast of Cape Hatteras lighthouse	31

The following tables show the mean velocity of the surface flow and the maximum daily variation observed at various stations:

Between Fowey Rocks and Gun Cay.

Station.	Distance east of Fowey Rocks.	Mean surface velocity observed.	Maximum daily variation observed.
	Miles.	*Miles.*	*Miles.*
1	8	2.66	2.38
1½	11½	3.46	1.83
2	15	3.16	1.67
3	22	2.73	.56
4	29	2.12	.58
5	36	1.71	.95

Between Rebecca Shoal and Cuba.

Station.	Distance south of Rebecca Shoal.	Mean surface velocity observed.	Greatest daily variation observed.
	Miles.	*Miles.*	*Miles.*
1	20	.30	.62
2	35	.74	1.15
3	50	2.24	.60
4	68	2.23	.80
5	86	.77	.82

Along the Florida Reefs between Alligator Reef and Dry Tortugas the distance of the northly edge of the Gulf Stream from the edge of the reefs gradually increases toward the westward. Off Alligator Reef it is quite close inshore, while off Rebecca Shoal and Dry Tortugas it is possibly 15 to 20 miles south of the 100-fathom curve. Between the reefs and the northern edge of the Gulf Stream the currents are ordinarily tidal, and are subject at all times to considerable modification by local winds and barometric conditions. This neutral zone varies in both length and breadth; it may extend along the reefs a greater or less distance than stated, and its width varies as the northern edge of the Gulf Stream approaches or recedes from the reefs.

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DIRECTIONS, NEW YORK TO STRAITS OF FLORIDA.

NEW YORK TO CAPE HATTERAS.—From Scotland light vessel steer 181° true (S ⅞ W mag.) for 42 miles, or from Ambrose Channel light vessel steer 186° true (S by W ⅜ W mag.) for 43 miles, to a position 8 miles off Barnegat lighthouse bearing 276° true (*WNW* ⅝ *W* mag.); then steer 193° 30′ true (S by W ¾ W mag.) for 287 miles to Diamond Shoal light vessel.

DELAWARE BAY TO CAPE HATTERAS.—From Overfalls light vessel steer 150° true (SSE mag.) for 23½ miles to Fenwick Island Shoal light vessel, and then steer 187° 30′ true (S by W ¼ W mag.) for 204 miles to Diamond Shoal light vessel.

CHESAPEAKE BAY TO CAPE HATTERAS.—From Chesapeake Bay entrance gas and whistling buoy steer 158° true (S by E ½ E mag.) for 72 miles to a position with Bodie Island lighthouse bearing 287° true (*WNW* mag.) distant 14 miles. Then steer 182° true (S ⅝ W mag.) for 40 miles to Diamond Shoal light vessel.

The *currents* may be expected to set with the wind up or down the coast. High velocities of current may occur either with heavy gales or with long-continued gales from one direction, the estimated maximum velocity near the coast being 2 to 3 knots. In depths of 20 fathoms or more, 0.5 to 1 knot is regarded as nearer an average of what may be expected. Currents produced by on-shore winds set inshore as well as alongshore.

CAPE HATTERAS TO JUPITER.—From Diamond Shoal light vessel there are two routes to the Straits of Florida. Most of the regular lines use the route outside of the Gulf Stream. All vessels bound to any port as far south as St. Johns River follow the coast inside the Stream.

OUTSIDE ROUTE.—From Diamond Shoal light vessel across the Gulf Stream make good the course 191° 30′ true (S by W ½ W mag.) for 173 miles to latitude 32° 15′ N., longitude 76° 00′ W. Under ordinary conditions an average allowance should be made for a 1-knot current setting 45° true for the entire run; with northeasterly winds there may be practically no current, while southerly, and especially southwest, winds may increase it considerably. Observations should be obtained as often as possible.

From the above latitude and longitude make good the course 211° 30′ true (SW by S mag.) for 300 miles to latitude 28° 00′ N., longitude 79° 00′ W. There is uncertainty as to the currents that may be expected on this run. It is probable that a Gulf Stream set of 0.5 knot against the vessel, and as the Bahama Bank is approached possibly some easterly drift also will be experienced. With northeast-

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erly winds it is stated that a southwesterly set of 0.5 knot has been experienced; this, and the easterly set mentioned, are the dangerous ones to guard against in order not to overrun and get too close to Matanilla Shoal. Observations are the only guide and should be obtained as often as possible; in case of doubt from about latitude 28° N. vessels can stand westward and watch the lead carefully to pick up the edge of the bank on the Florida coast northward of Jupiter.

Matanilla Shoal should be given a wide berth. It is stated that discoloration of the water can not be relied upon to avoid the shoal, the current setting on it not permitting this usual reef warning.

From the position in latitude 28° 00′ N., longitude 79° 00′ W., the course is shaped across the Gulf Stream for Jupiter Inlet lighthouse. On this course an allowance should be made for a northerly current, averaging about 2¼ knots for the entire run of about 80 miles. It will therefore be necessary to shape the course for a position some 8 or 10 miles southeastward of Jupiter Inlet light to allow for the northerly set. When fixing the position by bearings on the light, keep in mind that while outside the 100-fathom curve the vessel is probably in the full strength of the Gulf Stream, where the northerly current may average a velocity of 4 knots; if the light is on the starboard bow, the vessel will be much closer to it than indicated by the distance run between the successive bearings on it.

INSIDE ROUTE.—From 1 mile off Diamond Shoal light vessel make good a 229° 30′ true (**SW ¾ W** mag.) course for 149 miles, which leads close eastward of Cape Lookout Shoals light vessel and 1 mile eastward of Frying Pan Shoals gas and bell buoy. From the latter position make good a 234° 30′ true (**SW** by **W** mag.) course for 150 miles to lat. 32° 00′ N., longitude 80° 00′ W. Then make good a 203° true (**SSW ⅛ W** mag.) course for 65 miles to latitude 31° 00′ N., longitude 80° 30′ W. Then make good a 180° true (**S** mag.) course for 90 miles to latitude 29° 30′ N., longitude 80° 30′ W. Then make good a 169° true (**S** by **E** mag.) course for 52 miles, which should lead to a position 3 or 4 miles eastward of Hetzel Shoal gas and whistling buoy.

These courses lead in depths of 17 to 20 fathoms. In approaching and passing the shoals off Cape Canaveral care must be exercised; the depth should not be shoaled to less than 13 fathoms.

The *current* of the Gulf Stream may be expected under ordinary conditions to set against the vessel for the entire run with a velocity of about 0.5 to 0.8 knot, the direction of the current following the curve of the coast. It must be remembered, however, that the effect of winds is almost immediately felt on the currents, and that with northerly, and especially northeasterly, winds a current of about 1 knot will set with it along the coast. Southerly, and especially southwesterly, winds increase the velocity of the Gulf Stream.

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Passing 3 or 4 miles eastward of Hetzel Shoal gas and whistling buoy, a 168° true (S by E ⅛ E mag.) course will lead the same distance eastward of Bethel Shoal gas and whistling buoy, and this course should be continued until Jupiter Inlet lighthouse is made on the starboard bow. Then shape the course to pass from 3 to 6 miles eastward of it. On this run the 15-fathom curve is a good guide. The current of the Gulf Stream may be expected under ordinary conditions to have a velocity of about 0.7 knot off Cape Canaveral, increasing to 1.5 or 2 knots off Jupiter Inlet lighthouse.

STRAITS OF FLORIDA—CAUTION AS TO CURRENTS.—The attention of navigators is called to the fact that most of the wrecks on Florida Reefs occur in the case of vessels bound southward, especially at night; they generally occur on reefs lying about halfway between the lights; and the region of maximum frequency of wrecks is between Carysfort Reef and Alligator Reef, and to a less extent between Fowey Rocks and Carysfort Reef and between Alligator Reef and Sombrero Key.

From a consideration of the data it can be stated that nearly all casualties are due to one cause—an underestimate of the strength of the Gulf Stream against the vessel. This leads to two errors in navigation: First, the distance made good over the bottom is less than assumed or indicated by the log, and when skirting the reefs the course is changed too soon for the next light and before sighting it; second, the vessel underrunning her log is closer to the reefs than indicated by the four-point bearing, and this error is greater for slow vessels than for fast ones.

At night, when bound southward and navigating at a safe distance from the reefs between Fowey Rocks and Sombrero Key, it is on the side of safety to assume that the vessel is steaming against a 3 or 4 knot current, and from one light to hold a course that will insure clearing the reefs until the next light is sighted. It is also well to remember that near the reefs there is a tidal current, possibly as much as 0.5 knot in places directly on and off the reefs on the rising and falling tides, respectively.

On the other hand when bound northward and following Florida Reefs between Sombrero Key and Fowey Rocks it is on the side of safety to underestimate the velocity of the Gulf Stream with the vessel; the courses should be laid well clear of the reefs, which is the usual practice, Vessels are rarely lost on Florida Reefs when bound northward, except when crossing the Stream from Habana and making the reefs in misty or rainy weather.

The following are extracts from a report of a recent stranding:

Rounded Great Isaac light at a distance of 2¼ miles, steered by compass and log 227° true for 20 miles, and then steered 224° true. By bow and beam bearing Fowey Rocks light was 12 miles distant when abeam, but on account of the northerly current

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it was probably about 7 miles. The vessel stranded on the north end of Long Reef, having had a northerly set of 17 miles, or an average of about 2¼ knots for the crossing from Great Isaac light to Florida Reefs.

Along the keys there is a slight tidal drift, of not more than 0.5 knot, setting on and off the reefs. This current will probably not be noticeable at a greater distance from the reefs than 1 mile. Between the keys, in the passes connecting Hawk Channel and Florida Bay, the current has considerable velocity (3 to 4 knots) in the immediate vicinity of the openings, and is felt to some extent, probably, on and beyond the usual sailing line in Hawk Channel. When not influenced by winds the maximum current northwestward into Florida Bay and southeastward into Hawk Channel through the openings between the keys occurs about 1 hour before high and low waters, respectively, in the straits. The northwesterly current is increased by easterly winds and the southeasterly current by westerly winds, due to the effect of these winds in driving out or piling up, respectively, the water in Florida Bay.

JUPITER TO FOWEY ROCKS.—Vessels follow the coast as close as safety permits—in the daytime at a distance of 1 to 1½ miles to Hillsboro Inlet lighthouse, then 1½ to 2 miles off until abreast Biscayne Shoal buoy, and pass 1 mile eastward of Florida Reefs North End gas buoy and Fowey Rocks lighthouse. Close attention should be given to the lead, and courses not depended upon entirely, and checked frequently. From Jupiter to Lake Worth Inlet the depth should not be shoaled to less than 13 fathoms, and then keep in over 15 fathoms. Southward of Lake Worth Inlet the depths increase so rapidly offshore that the hand lead can not be depended upon to insure safety for deep-draft vessels.

The *current* of the Gulf Stream may be expected to have a velocity of 1.5 knots from well northward of Jupiter until southward of West Palm Beach, then 1 knot to Hillsboro Inlet, and then 0.7 knot to Fowey Rocks. The velocity increases rapidly offshore.

At night, from a position 6 miles off Jupiter Inlet light, make good a 183° true (**S** ⅛ **W** mag.) course for 82 miles, passing 2½ miles off the coast southward of Lake Worth Inlet, 3½ miles off Hillsboro Inlet lighthouse, 2½ miles off Florida Reefs North End gas buoy, and 2 miles off Fowey Rocks lighthouse. The 15-fathom curve is a safe guide between Jupiter and Lake Worth Inlet. On this course the *current* of the Gulf Stream should be assumed to have a velocity of 2 knots in determining the distance off the lights by bow and beam bearings, and more if farther offshore than the distances stated.

FOWEY ROCKS TO SAND KEY.—Vessels follow the Florida Reefs from 1 to 2 miles off in the daytime and 2 to 4 miles off at night. The position should be checked on the aids as passed and on the lights

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and sectors at night. Care must be taken not to get inside of the line of reefs, beacons (spindles), buoys, or lighthouses, especially when passing parts of the reef that lie well back of the edge and do not break or show near the surface. The color of the water does not always mark the edge of the reefs.

Except in the vicinity of Fowey Rocks, where the 100-fathom curve is only about 2 miles outside the reef, the 50-fathom curve lies from 2 to 3 miles from Florida Reefs, and this is about the least depth that can be depended upon to insure safety in skirting them. The hand lead is practically of no value as an aid and should not be depended on.

The reefs are fringed in places with broken ground, which as a measure of safety should be avoided by deep-draft vessels where the depths are less than 10 or 12 fathoms.

Any crossing of the Gulf Stream should be regarded as difficult, on account of the strong current of variable velocity for which it may not be possible to make a proper allowance and the abrupt shoaling inside the 100-fathom curve.

The axis of the Gulf Stream is nearest the reefs from about 10 miles northward of Carysfort Reef lighthouse to Molasses Reef.

Vessels bound for Habana generally shape the course for that port when abreast of Alligator Reef lighthouse.

The following courses may serve as a check, and the distances at which they are laid from the reefs should be regarded as a minimum to insure safety:

In the daytime.—From 1 mile off Fowey Rocks lighthouse make good the course 187° true (**S ½ W** mag.) for 7 miles to 1 mile off Triumph Reef beacon "O"; then 193° true (**S** by **W** mag.) for 6½ miles to 1 mile off Pacific Reef beacon "L"; then 203° true (**S** by **W ⅞ W** mag.) for 10 miles, passing ½ mile off Turtle Harbor buoy (nun, No. 2), and to a position 1 mile off Carysfort Reef lighthouse.

From 1 mile off Carysfort Reef lighthouse make good the course 207° true (**SSW ¼ W** mag.) for 6 miles to 1¼ miles off The Elbow beacon "J"; then 219° true (**SW ⅝ S** mag.) for 10 miles to 1¼ miles off Molasses Reef beacon "T"; then 234° true (**SW ⅝ W** mag.) for 16½ miles to 1¼ miles off Alligator Reef lighthouse.

From 1¼ miles off Alligator Reef lighthouse make good the course 234° true (**SW ⅝ W** mag.) for 11 miles to 1¼ miles off Tennessee Reef buoy (nun, No. 4); then 247° true (**SW** by **W ¾ W** mag.) for 11 miles to 2 miles off Coffin Patches beacon "C;" then 252° true (**WSW ¼ W** mag.) for 8½ miles to 1¼ miles off Sombrero Key lighthouse; then 253° true (**WSW ⅜ W** mag.) for 17 miles to 1⅜ miles off Looe Key beacon "G;" and then 257° true (**WSW ⅝ W** mag.) for 26½ miles, passing 1½ miles off American Shoal lighthouse and to a position 2 miles off Sand Key lighthouse.

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At night.—From 2 miles off Fowey Rocks light make good the course 187° true (S ½ W mag.) for 11 miles, keeping in the white rays of Fowey Rocks light, until Carysfort Reef light is in sight showing white; then 202° true (S by W ⅞ W mag.) for 13 miles to a position 2 miles off Carysfort Reef light.

A number of vessels have been lost on the reefs between The Elbow and Molasses Reef, and extra caution should be observed in this locality. The current against the vessel should be carefully considered in determining the position off Carysfort Reef light, from which to shape the course to lead well clear of The Elbow.

From a position 2 miles off Carysfort Reef light make good the course 209° true (SSW ½ W mag.) for 16½ miles until Alligator Reef light is in sight showing white; then 239° true (SW by W ⅛ W mag.) for 17 miles to a position 2½ miles off Alligator Reef light. The edge of the red sector of Carysfort Reef light leads close to the reefs between the light and The Elbow. It is proposed to establish a gas buoy off Molasses Reef; vessels can pass 2 miles off this buoy and make good a 236° true (SW ⅞ W mag.) course for 17 miles to a position 2½ miles off Alligator Reef light.

From a position 2½ miles off Alligator Reef light make good the course 236° true (SW ⅞ W mag.) for 14 miles until Sombrero Key light is in sight showing white; then 252° true (WSW ¼ W mag.) for 17 miles to 2 miles off Sombrero Key light; then 254° true (WSW ½ W mag.) for 23 miles to 2¼ miles off American Shoal light; and then 259° true (WSW ⅞ W mag.) for 20½ miles to 2 miles off Sand Key light.

SAND KEY TO DRY TORTUGAS.—On the south edge of Florida Reefs between Sand Key and Dry Tortugas there is broken ground with rocky, very uneven bottom, which, like other parts of Florida Reefs, rises abruptly from the deep water of the Straits of Florida. As a measure of safety this broken ground, including the areas with depths less than 10 or 12 fathoms lying southward and westward of Rebecca Shoal and Dry Tortugas, should be avoided by vessels of the deepest draft. The 50-fathom curve is about the least depth that can be depended upon to insure clearing this broken ground when skirting it, except southwestward and westward of Dry Tortugas. A vessel is reported to have struck an obstruction with about 18 feet over it lying 11 miles 147° true (*SE ⅞ S* mag.) of Rebecca Shoal lighthouse; the least depth found in this locality by a careful examination is 5½ fathoms. A vessel is also reported to have struck an obstruction 2 miles 285° true (*WNW ⅞ W* mag.) of Rebecca Shoal lighthouse.

The *currents* near the edge of the bank in this locality are variable, being influenced by the winds, by differences in barometric pressure

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in the Gulf and outside, and by the tides. There are strong tidal currents through the passage westward of Rebecca Shoal; a velocity of 1.5 knots has been observed in the passage, and 1.0 knot (north and south) on the edge of the bank southward of the passage. The tidal current on and off the edge of the reef should also be considered.

From a position 2 miles off Sand Key lighthouse make good the course 265° true (**W ¾ S** mag.) for 41 miles, passing nearly 4 miles southward of Marquesas Rock gas buoy, and to a position 13 miles from Rebecca Shoal lighthouse bearing 8° true (*N ½ E* mag.). Then make good the course 287° true (**WNW ¾ W** mag.) for 27 miles to a position 11½ miles 228° true (*SW* mag.) of Dry Tortugas lighthouse.

DIRECTIONS, STRAITS OF FLORIDA TO CAPE HATTERAS.

On the eastern side of the Gulf of Mexico for a distance of possibly 100 miles outside the 100-fathom curve, southeasterly currents prevail and velocities as high as 2.5 knots have been reported. The Gulf Stream investigations indicated that the strongest current into the Straits of Florida is found near the 1,000-fathom curve westward of Dry Tortugas, and that velocities of 1.5 to 2 knots are frequent in that locality. Approaching Dry Tortugas from the Gulf should therefore be regarded as a difficult run, as a vessel will overrun her log, and observations are the principal guide; currents may be expected at all times, but variations occur both in direction and velocity, due to the season of the year and the winds. Approaching the passage westward of Rebecca Shoal from northward, a number of vessels have stranded on New Ground Shoal, indicating an easterly set.

From Florida Straits to Cape Hatteras, vessels follow the Gulf Stream. Pass about 12 miles southwestward of Dry Tortugas lighthouse, about 14 miles southward of Rebecca Shoal lighthouse, then follow Florida Reefs about 8 miles off, and pass Fowey Rocks at a distance of 10 to 12 miles and Jupiter Inlet lighthouse 15 miles. The velocity of the current varies greatly in different localities, and is also subject to sudden changes, due to wind, differences in barometric pressure, and the like, so that no fixed hourly rate can be given. Frequently high velocities will be carried between certain points, and suddenly dropping off between others. The position should therefore be checked whenever possible by bearings. The ship speed plus supposed rate of current should not be assumed to fix the position. The greatest velocity will be found between Carysfort Reef and Jupiter Inlet, ranging from 2 to 4½ knots.

From 15 miles off Jupiter Inlet lighthouse make good the course 1° 30′ true (**N ⅛ E** mag.) for 208 miles to latitude 30° 25′ N., longitude 79° 40′ W. This should lead from 12 to 18 miles outside the 100-fathom curve, and should give a current nearly equal to the average made between Fowey Rocks and Jupiter.

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From latitude 30° 25′ N. and longitude 79° 40′ W. make good the course 26° true (**NNE ⅜ E** mag.) for 50 miles to latitude 31° 10′ N., longitude 79° 1.′ W. Then 45° 30′ true (**NE ¼ E** mag.) for 243 miles to latitude 34° 00′ N., longitude 75° 50′ W.

It is stated that between latitude 30° 30′ and 32° 30′ N. heavy tide rips will be experienced, indicating a change in the direction of the stream and not an increase in the velocity, and creating in stormy weather a very uncomfortable sea.

From latitude 34° 00′ N. and longitude 75° 50′ W. make good the course 22° true (**NNE ⅜ E** mag.) for 69 miles and pass eastward of Diamond Shoal light vessel. Then follow the tracks to ports northward as described in the southbound routes.

When approaching Diamond Shoal great care must be taken to have a correct location for the vessel. The currents are subject to wide variations, as indicated by the observations on the light vessels. At times during both summer and winter the Gulf Stream has great velocity; at other times none will be found, or a southerly set may be experienced with northerly winds. The general direction of the stream is northeast with a velocity of 1 to 2 knots, but on nearing Diamond Shoal light vessel the current is said to set well to the east-northeast and at other times nearly north. Overallowance and this northerly set have been fatal to many vessels. If a northerly gale is encountered between Jupiter and Cape Hatteras, some navigators keep closer inshore to get on soundings before reaching Diamond Shoal.

The courses given from Jupiter to Hatteras follow nearly the axis of the Gulf Stream. If followed, the best current will usually be obtained, but good observations are essential to avoid overrunning or underrunning. Due regard should be given to the seasons of the year. It is stated that winter currents are much lighter, often dropping to nothing after long spells of northerly and northeast winds.

DIRECTIONS FOR ENTERING STRAITS OF FLORIDA THROUGH PROVIDENCE CHANNELS.

The greater number of sailing vessels bound to the Gulf of Mexico from ports in Europe, British North America, or the northern Atlantic ports of the United States, and a large number of steamers from European ports, enter the Straits of Florida from eastward through the Providence channels, which have a least width of 22 miles between Great and Little Bahama Banks.

The point for which a course is shaped, and the first land sighted, is the south point of Great Abaco Island, known as Hole in the Wall. Vessels coming from northward, if at all doubtful of their reckoning, should make latitude 26° 30′ N., well eastward of the eastern end of Abaco Island, so that in case the wind falls light or the weather be-

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comes thick they will not be picked up by Elbow Key. At night, in a sailing vessel, if the wind is from southward when in this locality, and the light is not sighted or the reckoning is doubtful, the vessel's head should be kept eastward, as the lead will be of little use to give warning of danger. Near the northeastern end of Great Abaco Island the currents are strong and variable and have caused many wrecks in the vicinity of Elbow Key.

Caution.—A branch of the North Equatorial Current runs strongly on the eastern side of Bahama Islands, and several vessels have stranded between Hole in the Wall and Elbow Key. The current generally sets north-northwestward; its velocity is about 1.5 knots, increased during southeast winds, but it sometimes sets in an opposite direction.

In the Northeast Providence Channel the currents are variable and the reefs and keys should not be approached too closely in light winds. In the Northwest Providence Channel, between Great Stirrup Key and Great Isaac, the flood sets southward on the Great Bahama Bank and the ebb northward off the bank. In the middle of the channel there is generally but little current, except after northerly winds, when it frequently sets eastward with a velocity of about 1 knot. The tidal current has a velocity of about 1 knot on the banks, setting directly on and off on the rising and falling tide, respectively.

Steamers bound to ports in the Gulf of Mexico, after passing Great Isaac, will find it to their advantage to stand across the Straits of Florida for Fowey Rocks lighthouse and follow the Florida Reefs into the Gulf. The reefs are so well marked in the daytime, and at night by the red sectors in the lights, that no uncertainty as to the position of a vessel is possible with ordinary care. This route is also shorter than the one along the western edge of Great Bahama Bank and across Salt Key Bank.

Sailing vessels after passing Great Isaac stand along the western edge of Great Bahama Bank for a distance of about 75 to 80 miles and then stand for the northwest end of Salt Key Bank; or, if not over 18 feet draft, they can cross Salt Key Bank, passing either side of Dog Rocks and south of Double Headed Shot Keys, thus avoiding the strength of the Gulf Stream, which is weaker here than on its western side. From Salt Key Bank the wind generally decides whether the vessel bound into the Gulf of Mexico crosses the Straits of Florida so as to make Sand Key lighthouse, or follows the north shore of Cuba and crosses the straits so as to pass westward of Tortugas.

Vessels of less than 12 feet draft can stand across the northwest end of Great Bahama Bank after entering the Northwest Providence Channel, but this should not be attempted unless in the daytime, when the rocky patches can be seen so as to be avoided. A vessel

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using this route will leave the western edge of Great Bahama Bank about 78 miles southward of Great Isaac lighthouse, and southward of Orange Key.

THROUGH PROVIDENCE CHANNELS TO GREAT ISAAC AND FOWEY ROCKS.—When Hole in the Wall lighthouse is made, shape the course to pass from 3 to 5 miles southward of it; a narrow bank of soundings with depths of 9 to 12 fathoms extends 5 miles between the bearings southeastward and east-southeastward from Hole in the Wall. Then make good a 281° 30′ true (**W** by **N** mag.) course for 100 miles, passing 5 miles northward of Great Stirrup Key lighthouse and to a position near the edge of the bank with Great Isaac lighthouse bearing 231° true (*SW ½ W* mag.) distant 7 miles. Then round Great Isaac lighthouse at a distance of about 4 miles in a depth of about 12 or 13 fathoms.

The principal dangers are the *Gingerbread Ground* and the rocks and reefs lying between it and Great Isaac lighthouse, which have a total length of about 30 miles; and the greatest caution and attention to soundings should be observed in approaching this dangerous locality, as the flood tide sets directly on the reefs and in places parts of it are only about 1½ miles from the edge of the bank. From westward of Stirrup Keys to eastward of the Gingerbread Ground the northern edge of the bank is clear and the lead a safe guide, and vessels sometimes anchor here during light winds.

From northward of Great Isaac lighthouse steamers shape the course across the Gulf Stream for Fowey Rocks lighthouse. On this course an allowance should be made for a northerly current, averaging about 2¼ knots for the entire run. It will therefore be necessary to shape the course for a position some 8 or 10 miles southeastward of Fowey Rocks light to allow for the northerly set. When fixing the position by bearings on the light, keep in mind that while outside the 100-fathom curve the vessel is probably in the full strength of the Gulf Stream, where the northerly current may average a velocity of 4 knots; if the light is on the starboard bow, the vessel will be much closer to it than indicated by the distance run between the successive bearings on it. On account of the strong current and the abrupt shoaling inside the 100-fathom curve, the greatest caution should be observed in approaching Fowey Rocks, and in fixing the position from which to shape the course southward. (See the caution as to currents in the Straits of Florida on p. 38.)

TO STAND ALONG THE WESTERN EDGE OF GREAT BAHAMA BANK.—If possible, daylight should be selected for the run.

Having rounded Great Isaac lighthouse at a least distance of 3 miles, steer 223° true (**SW ¼ S** mag.) for 10 miles to pass outside Eldorado Shoal (depth 10 feet), taking care in the night not to come within the depth of 10 fathoms, or to bring the light to bear north-

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ward of 51° true (*NE ½ E* mag.) until the shoal is passed. The course may then be altered more southward to follow the edge of the bank in not less than 10 fathoms and pass outside Moselle Shoal buoy.

After passing North Bemini the keys must be closely hugged in order to avoid the Gulf Stream, which sometimes comes close to the rocks. A short calm, within a mile of the edge of this part of the bank, might drift a sailing vessel so far northward as to oblige her to run around Little Bahama Bank, and to enter again from eastward. Therefore, instead of attempting to beat along with a light wind, it is more prudent to anchor under North Bemini and await a slant of wind to get around the elbow.

In the winter when near Great Isaac, if the weather indications give warning of a northwester, it is advisable for a sailing vessel to remain in the Northwest Providence Channel and be guided by bearings on Great Isaac until the wind draws northward, which it usually does in 24 to 48 hours.

Vessels proceeding westward from Great Bahama Bank should endeavor to strike soundings on the northwest end of Salt Key Bank. Should the wind be scant from westward they may run in on the bank on either side of Dog Rocks and pass off southward of the Double Headed Shot Keys; or, should the wind be light and tending to calm, they may anchor on the bank to avoid being set northward. At night vessels had better run down westward of the bank, paying great attention to the lead.

It is advisable for sailing vessels not to stand over for Salt Key Bank until after reaching Orange Key. In the summer months, when light southeasterly winds prevail, a strong northwest current frequently runs into Straits of Florida from Santaren Channel, and vessels meeting with a calm or light airs at this period are sometimes drifted through the straits, even in sight of the keys along the edge of the bank.

Having passed Elbow Key lighthouse and being clear of Salt Key Bank, the course should be about 233° true (**SW ½ W** mag.) until close over to the coast of Cuba, to avoid the strength of the current. This course should lead toward the peak of Matanzas, and about 12 miles northwest of Piedras Key lighthouse, but this will depend upon where the vessel leaves the bank and the set of the current, which is very uncertain and sometimes strong into the Nicholas Channel. If bound to ports of the United States on the Gulf of Mexico, keep along the coast of Cuba as far west as Mariel, about 22 miles westward of Habana, and then shape a course to pass westward of Tortugas.

Vessels with a fair wind may shorten the passage by crossing over from Salt Key Bank to Sand Key lighthouse; a Gulf Stream current with a velocity of about 2 knots in a northeastly direction will be experienced.

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To cross Great Bahama Bank.—Vessels of less than 12 feet draft can stand across the northwest part of Great Bahama Bank from Northwest Providence Channel, but this should not be attempted unless in the daytime, when the rocky patches can be seen so as to be avoided. The distance with a depth less than 4 fathoms is 70 miles. About half of this distance carries a depth of a little more than 2 fathoms; 15 miles of this is known as the flats or Middle Ground, which has narrow sand ridges and small black heads, between which the vessel must be guided by eye.

Passing 1½ miles northward of Great Stirrup Key lighthouse, bring the lighthouse to bear 112° true (*ESE* mag.), distant 4 miles. Then steer 238° true (**SW** by **W** ⅛ **W** mag.) for 33 miles to the edge of the flats or Middle Ground, which extends across the bank and is about 15 miles wide; allowance must be made for the tidal current. Thence a 217° true (**SW** ¾ **S** mag.) course for 50 miles will lead to a position 5 or 6 miles southeastward and in sight of Orange Key, and the course continued will lead to the edge of the bank about 12 miles southward of it.

In crossing the flats the eye must be the guide between the numerous white sand ridges and the small black heads, which are easily seen even in the nighttime if the weather is clear. Should a vessel enter upon the bank with the first of the flood she should steer a little more westward, and more southward if she enters on the first of the ebb. Although the water is so shoal and clear, the lead should be kept constantly going, the lead line being marked to feet. If eastward of the track and approaching what is known as Long Bank, the little heads of sponge and dark fans will become more numerous. In the winter months, should the wind haul southward (a sure indication of a northwester), it is advisable to anchor and await the change instead of beating about among the shoals.

Tides.—It is high water, full and change, on the bank at 8 hours, and the current has a velocity of 1 to 0.5 knot to within a short distance of the north side of the Middle Ground. On the Middle Ground there is little current; and on the south side of the Middle Ground the current is rotary, setting from east to south and west from high to low water, and through north to east from low to high water.

About 16 miles eastward of Orange Key it is not high water, full and change, before 10 hours 15 minutes, and the rise is 3 feet, so that a vessel will carry 2 hours more of high water across the shallower part of the bank. A steamer of 12 feet draft, coming from northward and making the northern edge of the Middle Ground at three-quarters flood, may cross the Middle Ground before the tide begins to fall.

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COAST FROM CAPE HENRY TO CAPE LOOKOUT.[1]

Cape Henry, on the south side of the entrance to Chesapeake Bay, is a bold range of sand hills, 80 feet high, with lower ones near the water. On the beach at the cape is Cape Henry lighthouse, and 340 feet southwestward of it is a disused lighthouse tower. Near the lighthouse are a radio station, a storm-warning display station, and a seacoast telegraph station of the United States Weather Bureau, from which vessels are reported to Norfolk and with which they may communicate by the use of International Code Signals.

Cape Henry lighthouse is an octagonal, pyramidal tower, upper and lower half of each face alternately black and white. The light is fixed white, with a red sector, 157 feet above the water, and visible 19 miles. The fog signal is a siren, blast 4 seconds, silent interval 41 seconds.

Virginia Beach is a summer resort 5 miles southward of Cape Henry, and has railroad communication with Norfolk. The large hotels are prominent.

From Cape Henry to Cape Hatteras the coast trends southward for 103 miles, and is broken by two unimportant inlets. From Cape Henry southward for 11 miles there are woods near the beach, but for the remainder of the distance the coast is a low, narrow strip of land or sand beach, from ⅛ to 2¾ miles wide, separating the ocean from the extensive interior waters of North Carolina. Currituck Beach, Bodie Island, and Cape Hatteras lighthouses, Diamond Shoal light vessel, the buoys, and the lifesaving stations are the principal marks.

The coast between Cape Henry and Cape Hatteras is free from dangers if it be given a berth of 5 miles or more, and along the greater part of it 5 to 9 fathoms will be found as close as 1 mile from the beach. The shoals lying off this stretch of coast are False Cape Shoals, Platt Shoals, Wimble Shoals, and Hatteras Shoals. In navigating along this coast in thick weather the closest attention should be paid to the soundings and chart, and even then the navigator is likely to be confused and led into danger in consequence of the irregularities of depth.

About 21½ miles southward of Cape Henry there are two sand hills, one 60 and the other 40 feet high, called, respectively, Wash Hill and Sheep House Hill. When approaching from southward the locality resembles Cape Henry, and is called **False Cape**. Several spots with depths of 14 to 18 feet lie from ¾ to 1¾ miles offshore from False Cape. A gas and whistling buoy (occulting white light) is moored outside these shoals about 4¾ miles from shore.

Currituck Beach lighthouse, nearly 34 miles southward of Cape Henry lighthouse, is a red, conical tower. The light is fixed white 56.3 seconds, eclipse 14.2 seconds, flashing red 5.3 seconds, eclipse 14.2 seconds, 158 feet above the water, and visible 19 miles.

Bodie Island lighthouse, 36 miles southward of Currituck Beach lighthouse, is a conical tower, alternate white and black horizontal bands above granite base. The light is fixed white, 156 feet above the water, and visible 19 miles.

Oregon Inlet, about 2 miles southward of Bodie Island lighthouse, is entered over a shifting bar, the surveyed depth on which has varied from about 6 to 10 feet or

[1] Shown on charts 10, scale $\frac{1}{400,000}$; 1227, 138, 139, 145, 146, scale $\frac{1}{80,000}$, price of each $0.50.

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more. When inside the bar anchorage can be found under the lee of the south entrance point. The tidal currents have considerable velocity, sometimes from 3 to 4 knots, and even 5 knots on the ebb with strong westerly winds. About 4 feet at high water can be taken from the inlet over the bulkhead into Pamlico Sound through a difficult, shifting channel. There are no aids.

Platt Shoals are a number of spots with 4½ to 6 fathoms over them, lying from 2¼ to 3¾ miles from the beach, and from 6 to 9 miles southeastward of Bodie Island lighthouse. There is a good channel with a depth of 8 to 14 fathoms inside this shoal and about 1⅜ miles from the beach. The shoals are about 3½ miles long in a south-southeast direction and are about 1½ miles wide. In easterly gales the shoaler spots are marked by breakers.

New Inlet, the opening in the beach nearly 10 miles southward of Bodie Island lighthouse, is used only by small boats. The sea breaks across the mouth in all but very calm weather.

Wimble Shoals are a number of ridges extending out from and lying off the shore to a distance of 4 miles with depths ranging from 3½ to 6 fathoms. The northern end of these shoals is about 15 miles southward of Bodie Island lighthouse and eastward of the northern end of Chicamacomico Woods. The spot with 3½ fathoms over it lies about 2⅝ miles from shore, and there are several spots with 4 fathoms over them inshore of it. In easterly gales the shoaler parts are marked by breakers. A whistling buoy moored 4¼ miles offshore marks the outer limit of the shoals.

Cape Hatteras, where the coast makes a sharp bend westward, is low and sandy, and is marked by Cape Hatteras lighthouse. One mile northward of the lighthouse is a radio station. Westward of the lighthouse it is thickly wooded. There is a life-saving station about 1 mile southward of the lighthouse.

Cape Hatteras lighthouse is a black and white, spirally banded tower with a red brick base. The light is flashing white (light 2.3 seconds, eclipse 7.7 seconds), 191 feet above the water, and visible 20 miles.

Hatteras Shoals extend nearly 10 miles in a southeasterly direction from Cape Hatteras, and consist of a number of irregular shoals, some of which have 4 and 5 feet on their shoaler parts. The three principal shoals have distinctive names. The Spit extends about 2 miles southeastward from the cape.

Diamond Shoal lies 3 miles southeastward of the cape, has little water over it, and is usually marked by breakers. Outer Shoal is at the southeast extremity of Hatteras Shoals, and consists of irregular patches with least depths of 5 and 11 feet over them, which are usually marked by breakers and a wreck or two. Outer Slue Channel, the passage between Outer and Diamond Shoals, has a depth of about 3½ fathoms, but as there are several spots with only 14 and 16 feet over them, and as the channel is not marked, it is not safe to pass north of the Outer Shoal. During strong winds the currents set across the shoals with great velocity.

Wrecks on the Outer Shoal usually occur in the case of vessels approaching from southward in thick weather. The difficulty of making a proper allowance for the set of the Gulf Stream, and also the strong currents near the shore and the shoals, may cause considerable error in the reckoning. The lead and Diamond Shoal light vessel are the guides for clearing the shoals. When approaching and uncertain of

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the position, the greatest care should be observed, the lead kept going at frequent intervals until bottom is found, and care should then be taken not to get into less than 20, or preferably 30, fathoms.

Diamond Shoal light vessel is moored in a depth of 30 fathoms 13⅝ miles 137° true (**SE ⅝ S** mag.) of Cape Hatteras lighthouse. The vessel has a red hull, with "Diamond" on each side, two masts and a circular gallery under the lens lantern at each masthead. The lights are occulting white (light 25 seconds, eclipse 5 seconds), 57 feet above the water, and visible 13 miles. The fog signal is a steam chime whistle, blasts 5 seconds, silent interval 55 seconds. If the whistle is disabled the ship's bell will be struck by hand rapidly 5 seconds, silent interval 55 seconds. The submarine bell strikes "5," thus: 5 strokes in 9 seconds, silent interval 3 seconds. Wireless messages will be received and transmitted. Storm warnings are displayed during daytime only.

From Cape Hatteras to Cape Lookout the coast trends generally southwestward for 62 miles, and is broken by two inlets. From Cape Hatteras southwestward for 6 miles it is thickly wooded near the beach; between the woods and the beach is a range of sand hills from 10 to 40 feet high, and for the remainder of the distance the coast is a narrow sand beach, with numerous sand hills, separating the ocean from the extensive interior waters of North Carolina. Cape Hatteras, Ocracoke, and Cape Lookout lighthouses, Diamond Shoal and Cape Lookout Shoals light vessels, and the life-saving stations are the principal aids.

The coast between Cape Hatteras and Cape Lookout is fairly bold and 4 to 7 fathoms will be found as close as ½ mile from the shore, except off Hatteras Inlet, where shoals extend out 1¼ miles, and off Ocracoke Inlet, where they make out nearly 1¾ miles.

Hatteras Inlet, 11 miles westward of Cape Hatteras lighthouse, is entered over a shifting bar, the depth over which varies from about 12 to 14 feet. It is used as a harbor of refuge by small local coasting vessels, there being fair anchorage inside the bar in depths of 2 to 3 fathoms. Strangers should not enter without a pilot, as the buoys may not always mark the best water. Pilots are on the lookout for vessels, and will cross the bar when the sea permits.

The channel over the bulkhead from the inlet to Pamlico Sound is subject to change both in position and depth. By the latest survey, in 1909, the least depth found was 5 feet. The channel is used chiefly by local fishermen.

On the west side of the inlet the shore is a bare sand beach; Hatteras Inlet life-saving station is 1½ miles westward of the inlet and the most prominent object in that direction. About 2¼ miles eastward of the entrance is a clump of woods and a storm warning display station; on the beach in front of the woods is Durants life-saving station. A white church spire in the village of Hatteras is prominent.

Tides.—The range of the tide is about 2 feet on the bar. In the channels over the bulkhead the height of the water depends upon the direction and force of the wind.

Currents.—The tidal currents in the inlet and the channels through The Swash are much influenced by the winds and attain a velocity at times of 2 to 2½ knots. The flood current commences nearly 3½ hours after low water and the ebb current about 3 hours after high water.

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Ocracoke Inlet, about 26 miles west-southwestward of Cape Hatteras lighthouse and 15 miles from Hatteras Inlet, is entered over a shifting bar, the depth over which varies, according to the records of the surveys for many years back, from 10 to 12 feet. Strangers should not enter without a pilot, as the buoys may not always mark the best water. Pilots are on the lookout and will board vessels if the sea will permit them to cross the bar.

Inside the entrance there are several channels or slues which lead into the shoals lying northward of the inlet; **Teaches Hole Channel** is marked by buoys and lights, and leads northeastward along the western side of Ocracoke Island and then northwestward over the bulkhead into Pamlico Sound; a survey in 1905 found a least depth of 6 feet in the channel. **Wallace Channel** is marked by buoys, and leads northwestward from the inlet and through a former dredged channel over the bulkhead into Pamlico Sound; a survey in 1905 found a least depth of 4½ feet in this channel.

Ocracoke lighthouse and the village of **Ocracoke** are near a clump of woods on the eastern side of the entrance. Ocracoke lighthouse is a white tower. The light is fixed white, 75 feet above the water, and visible 14 miles. On the western side of the entrance is the village of **Portsmouth;** the life-saving station is the largest building and is nearest the inlet.

The best anchorage is in the channel off the village of Ocracoke, from just below the steamboat wharf to abreast the life-saving station; the depths range from 8 to 18 feet.

Tides.—The range of tide is about 2 feet over the bar and about 1 foot at Ocracoke. In the channels over the bulkhead the height of the water depends upon the direction and force of the wind.

Currents.—The currents in the inlet and the channels over the bulkhead are much influenced by the winds. The ebb current usually has a greater velocity than the flood, sometimes attaining a velocity of 2 to 2½ knots. The flood current commences nearly 3½ hours after low water and the ebb current about 3 hours after high water.

Cape Lookout is the extremity of a long and very narrow strip of sand beach projecting into the sea from the sharp angle of the coast which forms the point of division between Raleigh and Onslow Bays. The land near the cape is low, with sandhills from 10 to 40 feet high; the cape is, however, readily identified by Cape Lookout lighthouse, which can be seen at a distance of about 13 miles on a clear day.

Cape Lookout lighthouse is a black and white, diagonally checkered tower. The light is fixed white, 156 feet above the water, and visible 19 miles.

Cape Lookout Shoals extend 8¼ miles south-southeastward from the cape, their outer end, with a depth of less than 18 feet, lying 10 miles 165° true (S by E mag.) of Cape Lookout lighthouse. The greatest width of the shoals is about 1¾ miles, and the depth over them ranges from 2 to 18 feet. Lookout Breakers is the name given to a ridge on the shoals which has depths of 2 to 6 feet and lies about 8 miles from the lighthouse and 3 miles from the red buoy which marks the southern end of the shoals. In 1912 the wreck of a steamer stood on the shoals 4 miles southward of Cape Lookout lighthouse. Outside of Lookout Shoals proper and the buoy are two irregular shoals with 4¾ fathoms over them, which will be avoided by passing near the light vessel. In thick weather always use the lead, and if uncertain of the position do not go into a less depth than 14 fathoms.

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Cape Lookout Shoals light vessel is moored in 15 fathoms about 20 miles 163° true (S by E ⅛ E mag.) of Cape Lookout lighthouse and 9¼ miles 158° true (S by E ⅝ E mag.) of the buoy marking the south end of the shoals. This is the new position to which the light vessel will be moved about October 15, 1913, and all courses in this volume are given with reference to the new position. It has a red hull from bow to pilot house and from mainmast aft, midship section yellow, with "Lookout" on each side; two masts and brown, oval, cagework daymark at head of each. A fixed white light is shown from the foremast and a fixed red light from the mainmast, each 50 feet above the water and visible 13 miles. The fog signal is a steam chime whistle, blast 3 seconds, silent interval 17 seconds. If the whistle be disabled a bell will be struck by hand rapidly 3 seconds, silent interval 17 seconds. The submarine bell strikes "46," thus: 4 strokes in 5.6 seconds, silent interval 3 seconds, 6 strokes in 8.4 seconds, silent interval 5 seconds.

Lookout Bight is on the west side of Cape Lookout and affords good anchorage for large vessels except with winds from south through west to northwest. The anchorage is northward or northeastward of Wreck Point light, with Cape Lookout lighthouse bearing between 86° true (E mag.) and 109° true (ESE mag.), in 5 to 6 fathoms. A limited number of small vessels of about 9 feet or less draft can anchor, with shelter from all winds, inside the hook on which there are a number of huts; but the width of the anchorage, with depths of 10 to 18 feet, is only about 200 yards. To anchor inside the hook, pass 75 yards eastward and southward of the post, which stands near the east end of the spit 100 yards eastward of the huts, and anchor in the cove 200 yards southeastward of the huts.

When eastward of Cape Lookout Shoals, the greatest difficulty in making the anchorage in Lookout Bight is in the distance which must be run southward of the cape to clear the shoals. In easterly gales the shoals are marked by breakers, and when westward of them the sea will be somewhat broken. When westward of Cape Lookout Shoals, do not shoal the water to less than 8 fathoms until Cape Lookout lighthouse bears eastward of 41° true (NE mag.). Then give the western side of the cape a berth of over ½ mile until Cape Lookout lighthouse opens northward of Wreck Point light. The shoals on the west side of the cape, from about ½ mile southward of the life-saving station to Wreck Point light, rise abruptly from a depth of 6 to 7 fathoms.

BEAUFORT HARBOR[1]

is the southern entrance to the inland waterway between Beaufort and Norfolk Harbors and is the most important harbor on the coast between Cape Henry and Cape Fear. The most prominent and easily recognized objects are the standpipe near the large hotel at the eastern end of Morehead City and the large yellow Marine Biological Station and radio station close to it, on Pivers Island, near Beaufort.

Core Creek is a part of the inland waterway between Beaufort Harbor and Pamlico Sound and is described on pages 153 and 160.

Newport River, the approach to the Clubfoot Canal, is a broad shallow stream emptying into the head of the harbor. The canal is good for a depth of 3½ feet at high water.

[1] Shown on charts 147, scale $\frac{1}{80,000}$, price $0.50; 420, scale $\frac{1}{40,000}$, price $0.25.

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The entrance to Beaufort Harbor is about 7½ miles west-northwestward of Cape Lookout lighthouse; it is obstructed by a shifting bar which extends nearly 1½ miles seaward. Dredging is occasionally done to obtain a channel 300 feet wide and 20 feet deep across the bar; shoaling is liable to occur soon after dredging. Ample depth for the class of vessels using the inland passage can be expected at all times. The channel is marked by range lights and buoys. Inside the bar there is a depth of 3 to 5½ fathoms in the channel and secure anchorage for vessels.

Beaufort, a town on the eastern side of the harbor, is the terminus of a railroad and has communication by telegraph and telephone. There is no anchorage near the town, but there are several small wharves to which a draft of 6 feet can be taken at low water. A small supply of coal is kept on hand, and larger quantities can be had by giving notice well in advance; it can be had in lighters.

Beaufort is reached from southward through a dredged channel 100 feet wide and 7 feet deep, the entrance to which is marked on its west side by **Shark Shoal light** (horizontally striped structure off the south end of a stone jetty on Shark Shoal). From the entrance the channel leads northward along the jetty, then to pass eastward of **Reids Creek light** (black structure), then curves northeastward to the northwest end of Town Marsh, then along the southeast side of the marshy islet northward of Town Marsh, and then northward for the passage between **Pivers Island** (marked by radio station and several large yellow buildings) and Beaufort until up to the small wharf at the western end of the town. Here a channel 200 feet wide and 10 feet deep runs southeastward along the wharves, and another channel leads northward past the railroad wharf.

A dredged channel 60 feet wide and 10 feet deep leads northward from Beaufort through **Gallants Channel** to the main channel of the inland waterway between Beaufort Harbor and Pamlico Sound. The channel is crossed at Beaufort by a drawbridge (opening 29 feet wide), from which it trends northward for ⅝ mile, to the fish factory wharf, then northwestward for ½ mile toward Newport Marshes upper light, then 34° true (**NE ⅝ N** mag.) for nearly ⅝ mile with two range beacons in line ahead, and then 348° true (**N ¾ W** mag.) for ⅞ mile, with two range beacons in line astern, to Russells Creek light, on the west side of the main channel of the inland waterway. The unmarked part of the channel is not difficult at low water, the sides of the cut then showing by a difference in the color of the water.

Morehead City, on the western side of the harbor, has communication by railroad, telegraph, and telephone, and is a shipping point for oysters, fish, and clams. The railroad wharf extends to deep water of the channel on the west side of the harbor near the drawbridge, and both are prominent. A channel 10 feet deep, with a least width of 100 feet, leads from Beaufort Harbor to the wharves of the town. From near buoy No. 3 in Bogue Sound the channel trends about 320° true (**NW ¾ N** mag.) for the cupola of the hotel until abreast a spindle on the port hand, then 293° true (**NW by W ⅝ W** mag.) close to the end of the hotel wharf, and then along the wharves.

Anchorage can be had in the channel of Beaufort Harbor from Fort Macon to the railroad bridge, and vessels of 8 feet or less draft can anchor, convenient to Morehead City, in the channel of Bogue Sound westward of buoy No. 3.

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Pilots will come out to a vessel if the sea will permit them to cross the bar. They can also be obtained here to take vessels along the coast and into the inlets between Beaufort and Cape Fear.

Supplies.—Coal, gasoline, ice, fresh water, provisions, and some ship chandlery can be obtained at Morehead City or Beaufort. Repairs can be made to small craft, which can be hauled out at both places.

Hospital.—The nearest marine hospital is at Wilmington, N. C. At Beaufort there is a relief station of the United States Public Health Service.

Storm warnings are displayed at Beaufort and Morehead City.

Tidal data is given in the table on page 30.

Currents.—The tidal currents in the entrance run with considerable velocity, especially during spring tides. They generally follow the direction of the channel, but on the last quarter of the flood and first of the ebb they are apt to set across the shoals in the entrance.

DIRECTIONS, BEAUFORT HARBOR.

From Cape Lookout Shoals light vessel a 327° true (**NNW ⅝ W** mag.) course made good for 25½ miles will lead 1¾ miles westward of the red buoy on the end of Cape Lookout Shoals, and to Entrance bell buoy.

From Frying Pan Shoals light vessel a 41° true (**NE** mag.) course made good for 86 miles will lead to Entrance bell buoy.

A good lookout for Entrance bell buoy should be kept as soon as Cape Lookout lighthouse bears southward of 97° true (*E* by *S* mag.). The prominent standpipe in Morehead City bearing 345° true (*N* by *W* mag.), or the large yellow building of the Biological Station near Beaufort bearing 12° true (*N* by *E* ⅝ *E* mag.), will lead to the bell buoy.

From Entrance bell buoy steer 37° true (**NE ⅜ N** mag.) with Shackleford Point range lights in line ahead until up with the perpendicularly striped buoy, which is on the bar at the intersection of the ranges. From this buoy steer 20° true (**NNE ⅛ E** mag.) with Bird Island range lights in line ahead, and pass about midway between buoy No. 1 and the horizontally striped buoy on the eastern side of the channel. From the latter buoy steer 334° true (**NNW** mag.) to a position about 100 yards westward of buoy No. 4. Then steer 297° true (**NW** by **W ¼ W** mag.), and give the shore above Fort Macon a berth of 150 yards. Leave buoy No. 6 on the starboard hand, and follow the marsh at a distance of 125 yards. When the outer end of the railroad wharf bears 345° true (**N** by **W** mag.) steer for it, which will lead eastward of the horizontally striped buoy on the north side at the entrance of the channel leading to Bogue Sound.

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COAST FROM CAPE LOOKOUT TO CAPE FEAR.[1]

The coast extends about 8 miles in a northwesterly direction from Cape Lookout and then curves gradually westward and southward to Cape Fear. This coast, nearly 100 miles in length, is similar to that between Cape Hatteras and Cape Lookout, but the strips of land forming it are separated from the mainland by much narrower bodies of water, and consequently the thick woods of the mainland can be seen from much farther seaward. That part of the Atlantic Ocean bordering on this curved coast is known as **Onslow Bay.**

The depths along this stretch of coast are very regular; 4 to 6 fathoms can be taken to within 1 mile of the beach; the 10-fathom curve extends nearly parallel to, and at an average distance of about 8 miles from, the shore until eastward of Cape Fear, where it bends southward and eastward around Frying Pan Shoals. The 20-fathom curve is from 20 to 45 miles offshore.

Inside passages.—Westward of Beaufort Harbor there is an inside passage as far as Bear Inlet for boats of 4 feet draft, and as far as New River Inlet for 3 feet draft; a draft of 2 feet can be carried at high tide as far as Wrightsville Inlet. There are several inlets between Beaufort Harbor and Cape Fear through which 6 or 7 feet at high tide can be taken to sheltered anchorage, but all are obstructed by shifting bars on which the sea breaks when at all rough.

With local knowledge, a smooth sea, and high water, boats of 5 feet or less draft can enter Cape Fear River through Corncake Inlet, and boats of about 6 feet or less draft can cross Frying Pan Shoals by the swash channel. Otherwise, all vessels must pass outside Frying Pan Shoals, by which route the distance from Entrance bell buoy off Beaufort Harbor to smooth water in Cape Fear River is 112 miles. Pilots for the inlets, inland passages, and open waters between Beaufort and Charleston can be had at Beaufort.

Bogue Sound is shallow, extends 21 miles westward along the coast from Beaufort Harbor to Bogue Inlet, and is separated from the ocean by **Bogue Banks,** a wooded beach ⅛ to ¾ mile wide. The sound has a width of about 2 miles near its middle, but narrows at each end; its western end is partly closed by marshy islets. A channel, partly dredged, extends through Bogue Sound from Beaufort Harbor to Bogue Inlet, and is navigable for a draft of 3 feet at low water and 4 feet at high water.

The channel is buoyed from Beaufort Harbor nearly to **Carolina City** (fish factory). Westward of Carolina City the channel follows the north shore at a distance of ⅛ to ¼ mile, and is marked by a few stakes with black or red boards pointing to the channel; red stakes are left on the starboard hand and black on the port, going west. About 2 miles westward of Carolina City there is a pile which marks the south side of a short dredged cut through a shoal. There is a black beacon off the mouth of Gales Creek, 7¼ miles westward of Carolina City; 2 miles farther westward is the beginning of the dredged cut which follows closely the north shore for 4⅜ miles to Shelly Point, and is well marked by lights and piles. The channel follows closely the shore in the bight on the west side of **Shelly Point** until north of an islet, and then follows the lights.

[1] Shown on chart 11, scale $\frac{1}{400,000}$; 147, 148, 149, 150, scale $\frac{1}{80\,000}$; price of each $0.50.

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From the last light the channel is marked by stakes, and leads close to the south end of Hunting Island, then westward to the marshy islets, and then between them and the wooded north shore. Thence through **Burthen Channel** there are no stakes, but the passage through the marshes is readily recognized. On the northwest side of Burthen Channel where it bends southward there is a dredged cut to **Cross Stakes Slough**, which leads between the marsh islands and the north shore into Main Channel, and is the route to Swansboro from Bogue Sound.

The channel to Bogue Inlet and New River Inlet follows the northwest side of Burthen Channel into Main Channel, where it follows closely the marsh on the north side, passing northward of two islets which are connected by bars with the south shore. From the southwest point of these marshes the channel crosses to the marshes on the west side of **Bank Channel**, passing northward of a shoal; and then leads southward for the life-saving station on the east side of Bogue Inlet, passing between two shoals marked by small stakes. The channel then leads across the inlet to the wooded shore on the west side, passing close to a red buoy.

Tides in Bogue Inlet vary from about 3½ feet average rise and fall at each end, near the inlets, to about 1 foot where the tides meet, near the middle. Strong south or southwest winds may raise the tide a foot or even more, and north to northwest winds lower it a corresponding amount.

From Bogue Inlet to New River Inlet there is an inside passage which has been improved in places by dredging; it has a minimum width of 40 feet in the cuts, and a minimum depth of 4 feet at mean high tide. The passage is not marked, but the evidence of dredging is a sufficient guide at present, except through the marshes between Bear and Brown Inlets, where a stranger may encounter some difficulty.

Tides in this passage vary from an average rise and fall of about 3½ feet at the inlets to 1½ feet at points remote from the inlets; the latter may be increased to 2 feet by strong southerly winds.

From Bogue Inlet the channel follows the wooded shore northwestward to an opening in the marsh beside a small hammock of trees northward of the woods. Enter here, and pass through a short dredged channel to natural passages which are approximately parallel to the coast; take the left passage where there are passages of about the same width, and be guided by evidence of dredging. When approaching Bear Inlet keep close to the sand beach to avoid shoals extending well off the marshes.

Strangers are advised to leave the inland waters and pass out at Bear Inlet, as the channel to New River Inlet is available only at high water and is difficult. From Bear Inlet the channel follows the sand beach to the marshes. It then winds through passages in the marsh from ½ to ¾ mile back from the beach, and is the most difficult place for a stranger; there are evidences of dredging in places, but the principal guide is the trend of the passages and a few small stakes which are left on the port hand. The channel then trends southward to Brown Inlet, where it follows the beach closely across the inlet.

From Brown Inlet to Crag Point the channel is easier to follow; it runs approximately parallel to the coast at a distance of ⅛ to ⅜ mile, and passes through one pond a little over ¼ mile long. The shallowest place is just east of Crag Point, where care is required to keep in the best water. At Crag Point the channel is through a dredged cut

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across the south end of **Solliers Bay**, and then leads westward through the marshes and north of Wrights Island into New River Inlet about ⅜ mile above its entrance.

From New River Inlet to Wrightsville Inlet there is a continuous passage said to be navigable for a draft of 2 feet at high tide. It is used to some extent by fishermen in small power boats, but is said to be difficult to follow.

Bogue Inlet is 22 miles westward of Beaufort Harbor, and 3 miles southward of the town of Swansboro, which can be seen from outside. The inlet is between a high wooded ridge on the west and a long, low spit on the east; on the inside of the spit, ¾ mile eastward of the inlet, is a life-saving station. The entrance is obstructed by a shifting bar, extending about ½ mile seaward, through which the channel depth varies from a minimum of 4 feet at low tide in some years to a maximum of 14 feet at high tide in other years; in February, 1912, there was a depth of 5 feet on the bar. The tides have a range of about 3½ feet on the bar, and high water occurs 2 hours earlier on the bar than at the head of the marshes inside. The channel is marked by a sea buoy, ½ mile outside the bar, and by small buoys on the bar and in the entrance. There are no regular pilots; some one familiar with the channel may sometimes be had from the life-saving station. A stranger should wait for a rising tide, and should never attempt to enter when the bar is breaking; the bar buoys can not be seen when there is any sea on.

From the inlet to **Swansboro**, a distance of 4 miles, the channel has a depth of 4½ feet at low water. The channel is obstructed by shoals, and at high tide the marshes on each side are covered, rendering it difficult for a stranger to follow.

White Oak River, for a distance of 4 miles above Swansboro, has a width of 1 mile or more, through which there is a narrow, tortuous channel between flats and oyster rocks; farther up the river is narrow and leads between marshes. **Stella** is a post office about 7 miles above Swansboro. Boats of about 4 feet draft have towed logs on the river as far up as 6 miles above Stella. Lumber is towed through Bogue Sound to Morehead City.

Bear Inlet, 3½ miles westward of Bogue Inlet, is considered the safest along this coast, and is used considerably by pleasure craft bound to or from the inside waters. The entrance is about ¼ mile wide between high sand dunes. It has a narrow, nearly straight channel between well-defined shoals, but there are no aids. In May, 1912, there was 6 to 7 feet on the bar at low water.

Brown Inlet, 3 miles westward of Bear Inlet, is shallow and should not be used. The entrance is similar in appearance to Bear Inlet.

New River Inlet, 35 miles westward of Beaufort Harbor, is considered dangerous by local pilots, and should not be attempted except under the most favorable conditions. There is a strong ebb current from the inlet, sometimes as long as 3 hours after low tide, which causes a heavy break on the bar when there is any sea outside. In May, 1912, there was 4 feet at low tide on the bar, which was broad and showed no well-defined channel. The entrance is narrow, with spits on both sides, and only shows when open. On the western side of the opening there is a wooded hammock on which there is a house partly concealed among the trees.

Tides.—The mean rise and fall at these inlets is about 3.5 feet; but freshets, particularly in New River, may raise the level a foot more inside. On the bars at the

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entrances of the inlets between Cape Lookout and Cape Fear high and low waters are about 1 hour earlier than at Charleston.

New River is navigable for boats of 5 feet draft for a distance of 7 miles above **Jacksonville**, the latter being a town on the railroad 20 miles above the mouth of New River Inlet. The river has a width of 1 to 2 miles from the head of the marshes above the inlet to 1 mile below Jacksonville, above which it is a narrow stream. From the inlet the channel to New River has a depth of 4 to 6 feet and leads northward and northwestward to the northern end of Chadwicks Bay, where it follows the southwest side of a dike. It then follows the western shore at a distance of 200 yards, passes that distance eastward of Hatch Rock, and then turns eastward to the middle of the river. Improvements are in progress to secure a channel 200 feet wide and 5 feet deep in the obstructed part of the passage for a distance of about 2 miles from the inlet.

New Topsail Inlet is 18 miles westward of New River Inlet and 53 miles westward of Beaufort Harbor. The opening is about ⅜ mile wide between low spits, and is obstructed by a shifting bar. A small house stands on the eastern spit, about ⅛ mile from its end. This inlet is used sometimes as an anchorage by small pleasure craft; the channel is not buoyed. In May, 1912, there was at low tide a least depth of 6½ feet in the channel over the bar, 7½ feet inside the bar, and from 3 to 4 fathoms inside the inlet, close to the western side. At that time the mouth of the inlet was closed by shoals, dry at low tide, except for a narrow channel close to the western spit. This channel crossed the bar in a general northwest direction and ran in close to the western spit where it branched, one part following close under the northern shore of this spit, and the other, turning northward, skirted the northern side of the shoal, which blocked the entrance, to the eastern spit opposite the house. Both channels were very narrow and varied in depth from 8 to 24 feet. Strong ebb currents are found in the mouth of the inlet, especially after heavy rains.

Old Topsail, Rich, and Queens Inlets are 2 miles, 5 miles, and 8½ miles, respectively, westward of New Topsail Inlet, and have channel depths over their bars of about 4 feet at low tide. They are used to some extent as anchorages by small pleasure craft, but are not recommended to strangers.

Wrightsville Inlet is 11½ miles southwestward of New Topsail Inlet and 23¾ miles north-northeastward of Cape Fear lighthouse. Lying 2½ miles southwestward is **Masonboro Inlet**, and on the beach between the two inlets is the summer resort of **Wrightsville Beach**, the large hotels and buildings of which are visible from far offshore. Wrightsville inlet is used to a considerable extent as an anchorage for small yachts. The opening is a little over ⅛ mile wide between spits, and is from ¼ to ½ mile northeastward of the most northern hotel on the beach. A bar extends less than ½ mile seaward from the opening, and in May, 1912, the minimum channel depth on it was 6 feet at low water. At that time shoals extended seaward, on each side of the channel, from the spits at the opening; and a shoal reached more than halfway across the opening from the southern spit, leaving a narrow channel close under the northern spit. Vessels can find anchorage in the lee of either spit or can go southward as far the bridge, carrying from 5 to 7 feet. An electric railway connects Wrightsville Beach with Wilmington. The average rise and fall is about 4 feet.

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Corncake Inlet, 4 miles northward of Cape Fear lighthouse, is connected with Cape Fear River by a shallow passage north of Smith Island, known locally as Cedar Creek or the Thoroughfare; it is much used by small craft to avoid rough water on Frying Pan Shoals and is a short cut from northward into Cape Fear River. In May, 1912, there was 3½ feet at low water on the bar and 1½ feet in the shallowest part of the channel through to Cape Fear River, and a draft of 5 feet could be taken through at high water. The bar was short and close to the entrance and the channel over it was narrow and well defined by shoals on each side, the shoal on the northern side being nearly bare at low tide; the entrance was ⅛ mile wide between low sand spits. Boats often enter the inlet as soon as the height of tide permits and anchor just inside, close to the southern spit, until able to go through into the river.

From the inlet the channel follows the western shore of the southern spit at a distance of 50 to 100 yards until within 50 yards of the marsh, and then crosses Buzzard Bay on a course about 245° true (**WSW** mag.). The crossing is the shallowest place, beyond which there should be little difficulty getting into the river. The channel trends southwestward and southward at a distance of 50 to 100 yards off the marshy islets on the western side, until down to the last one, which at high tide shows only as a few tufts of grass. Rounding this islet the channel trends about 324° true (**NW** by **N** mag.) until abreast a concrete pile on the starboard hand; then about 245° true (**WSW** mag.), following the northern shore of Smith Island and passing close to a narrow point of marsh on the starboard hand; then 284° true (**WNW** ½ **W** mag.) until abreast a small hammock of cedars on the marsh near Cape Creek; then 268° true (**W** mag.) for the water tower at Fort Caswell until the western point at the entrance of Cape Creek is in line with Cape Fear lighthouse; and then about 222° true (**SW** mag.) into the river.

Tides.—The average rise and fall is about 4 feet, and the tides are about 1 hour earlier than at Charleston.

Cape Fear is the low, sharp point of sand beach forming the southern extremity of Smith Island. This island, lying on the eastern side of the entrance to Cape Fear River, is mostly low and marshy, but has a thick growth of trees on its western side. Near the southern end of the island is Cape Fear lighthouse, which will usually be the first object seen in approaching the cape.

Cape Fear lighthouse is a white, iron, skeleton tower, upper part black. The light is flashing white (light 2.3 seconds, eclipse 7.7 seconds), 159 feet above the water, and visible 19 miles.

Bald Head lighthouse is on the westerly side of Smith Island, easterly side of the entrance to Cape Fear River. The structure is a white, octagonal, pyramidal tower. The light is fixed white with a dark sector between 220° and 308°, 99 feet above the water, and visible 16 miles.

Cape Fear Swash is a narrow channel across Frying Pan Shoals about ½ mile southward of Cape Fear. It is used to a considerable extent by local craft, and vessels up to 9 feet draft have gone through at high tide; but the shoals shift so frequently that no directions that would be of any assistance to a stranger can be given. Local pilots and fishermen, who use this swash, depend entirely upon soundings and the appearance of the breakers to find the best water.

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Frying Pan Shoals, with general depths of 7 to 14 feet, extend in an unbroken line 10 miles south-southeastward from Cape Fear; for a distance of 5½ miles farther in the same direction the shoals are broken, the depth over them ranging from 10 to 24 feet. Frying Pan Shoals light vessel is moored off the end of this part of the shoals, and a red whistling buoy is moored off the western side of the shoals, nearly 8½ miles northwestward of the light vessel. Broken ground with depths of 6 to 7 fathoms extends 7 miles eastward and 12 miles east-southeastward from the light vessel; the least depth is 3¾ fathoms, and lies 9 miles 99° true (E by S mag.) of the light vessel. The outer end of the shoals is marked by a gas and bell buoy (flashing white light), which lies 12 miles 118° true (SE by E ¼ E mag.) of Frying Pan Shoals light vessel. Large, deep-draft vessels generally pass southward of the gas and bell buoy.

Frying Pan Shoals light vessel is moored in a depth of 10 fathoms, 18½ miles 156° true (S by E ⅞ E mag.) of Cape Fear lighthouse. The vessel has a yellow hull, with "Frying Pan" on each side, and two masts with the lantern on the foremast. The light is fixed white, 68 feet above the water, and visible 14 miles. The fog signal is a steam chime whistle, blast 5 seconds, silent interval 55 seconds. If the whistle is disabled, a bell will sound 5 strokes in 5 seconds, silent interval 55 seconds. The submarine bell strikes 1 stroke every 3 seconds.

CAPE FEAR RIVER.[1]

Cape Fear River has a total length of about 371 miles, and empties into the sea immediately westward of Cape Fear. It is the approach to the city of Wilmington, which is 27 miles above its mouth. Frying Pan Shoals light vessel, Cape Fear lighthouse, and Bald Head lighthouse are the principal guides for the approach, and are described with the coast from Cape Lookout to Cape Fear.

The entrance of the river is obstructed by a bar which extends about 2 miles offshore. The channel is under improvement to secure a depth of 26 feet from sea to Wilmington, with a width of 400 feet across the bar, 300 feet in the river, and increased width at the bends. In June, 1912, the full depth had been obtained but not the full width in places. The channel is well marked by range lights and buoys, and with the aid of the chart it should not be difficult for a stranger of 16 feet draft to navigate it on a rising tide; sailing vessels usually employ a towboat for crossing the bar and in the river.

Southport is a town on the west side of the river about 2½ miles above Bald Head lighthouse. It has communication by steamboat and railroad with Wilmington. Supplies in limited quantities, fresh water, and gasoline can be obtained.

The city of **Wilmington** is on the east bank of the river, 27 miles above its mouth; it is the chief port of the State of North Carolina, and has considerable trade in cotton, lumber, and fertilizers. The city has railroad communication and steamboat communication with the river landings.

Cape Fear River above Wilmington has a low-water depth of 8 feet to **Kings Bluffs**, 34 miles; 2½ feet to **Elizabethtown**, 64 miles; and 2 feet to **Fayetteville**, 100 miles, the head of navigation; a depth of about 18 feet at low water can be taken 3¾ miles up the

[1] Shown on chart **150**, scale $\frac{1}{80,000}$; and in parts on charts **424, 425**, scale $\frac{1}{40,000}$; price of each $0.50.

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river to the fertilizer works near the railroad bridge. It is proposed to improve the channel by means of locks and dams, one at Kings Bluffs and the other at **Browns Landing**, 34 and 64 miles, respectively, above Wilmington, to secure a low-water depth of 8 feet to Fayetteville. This river is called **Northwest Branch** for a short distance above Wilmington.

Northeast River, known locally as **Northeast Branch**, empties into Cape Fear River from northeastward at Wilmington; a depth of 16½ feet at low water can be taken about 2¼ miles above Wilmington. It has a low-water depth of 6 feet to **Bannerman Bridge**, 42 miles; and 3 feet to **Croom Bridge**, 49 miles. Above Croom Bridge for a distance of 41 miles to **Kornegays Bridge**, the river is so shallow that navigation is practicable only during high-water stages.

Black River empties into Cape Fear River about 12½ miles above Wilmington, and has a low-water depth of 5 feet to **Point Caswell**, 21 miles; 2½ feet to **Haws Narrows**, 28 miles, and 1½ feet to **Clear Run**, 57½ miles. Above Clear Run for a distance of 7 miles to **Lisbon** the river is so shallow that navigation is practicable only during high-water stages.

Anchorages.—On account of the Government submarine cable, vessels are cautioned not to anchor on or near a line from Bald Head lighthouse to Fort Caswell. The best anchorage is off the town of Southport, where the depth ranges from 4 to 6 fathoms; the holding ground is good, but on account of the strong tidal currents vessels should anchor with a good scope of chain. This anchorage is sometimes used as a harbor of refuge in the winter by coasting vessels. There is a limited anchorage basin abreast the lower end of Wilmington, on the easterly side of the river just above the mouth of Alligator Creek.

National Quarantine.—The quarantine and boarding station is on the east side of the channel about 1 mile above Southport.

Pilots for the bar and river may be found off the entrance, or they will come out in answer to signal. Pilotage from sea to Southport is compulsory for certain vessels. Extracts from the regulations relating to pilots and pilotage are given in Appendix I.

Towboats can be had at Southport or Wilmington.

Harbor regulations and wharves.—The harbor master at Wilmington has control of the berthing and anchorage of all vessels. For harbor fees, see Appendix I. The depth alongside the wharf at Southport is about 15 feet, and at the Wilmington wharves 12 to 26 feet.

Supplies.—Provisions and ship chandler's stores can be had at Wilmington; coal for steamers can be had alongside the wharves or out in the stream from lighters. Fresh water can be had from a water boat or alongside the wharves through pipe and hose; it is also taken from the river at Wilmington.

Repairs.—Ordinary repairs to the machinery of steamers can be made at Wilmington; there is a marine railway here capable of hauling out vessels of about 1,200 tons register. The draft that can be hauled out at high water is 10 feet forward and 16½ feet aft.

Storm warnings are displayed at Wilmington, Southport, and at the life-saving station on Oak Island.

Hospital.—A United States marine hospital is located at Wilmington.

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Tides.—See the tide tables for the Atlantic coast of the United States, in which the tides are predicted for every day at Wilmington. Proceeding toward the mouth of the river the tides are earlier than at Wilmington, the differences for high and low water, respectively, being—Brunswick River entrance, 36m. and 51m.; Orton Point, 1h. 34m. and 2h. 18m.; Southport, 2h. 14m. and 3h. 33m.; Bar, 2h. 34m. and 3h. 56m. The mean range at the entrance is 4.5 feet, and at Wilmington 2.7 feet.

Currents.—The tidal currents on the bar run with considerable velocity, and as a rule set nearly in the direction of the channels, but on the last of the flood and first of the ebb they tend more or less across the shoals. In the river their set is generally in the direction of the channel, and during freshets the ebb has great velocity, sometimes entirely overcoming the flood. Abreast of Southport the estimated velocity of the ebb at strength of spring tides is 2.5 to 3.5 knots. At ordinary times a strong flood is felt for a considerable distance above Wilmington, where it runs 5¼ hours to nearly 7 hours of ebb; going down the river from Wilmington the periods of flood and ebb become more nearly equal. On the bar slack water occurs about 1 hour after high and low water.

Freshets.—Low-water stages prevail in the rivers above Wilmington from two to four months during the summer, and freshets usually occur as often as once a month during the rest of the year, but with no regularity.

DIRECTIONS, CAPE FEAR RIVER TO WILMINGTON.

The channel from sea to Wilmington is a dredged cut from 300 to 400 feet wide, the currents have considerable velocity, the dredged channel across the bar is subject to a gradual change in position, and strangers are advised to take a pilot. Unless with a local pilot, vessels do not run the river at night; sailing vessels require a towboat.

Between Reeves Point and Wilmington extensive changes are in progress in the aids, which will be completed in the latter part of 1913. The directions for this part of the river lead in the axis of the cuts, using the new system of aids.

1. FROM NORTHWARD.—The safer course, and the one generally used by large, deep-draft vessels, is to pass outside of Frying Pan Shoals gas and bell buoy. From Cape Lookout Shoals light vessel a 230° true (**SW ¾ W** mag.) course for 78 miles will lead to Frying Pan Shoals gas and bell buoy, or a 238° true (**SW** by **W ⅜ W** mag.) course made good for 84 miles will lead to Frying Pan Shoals light vessel.

From Frying Pan Shoals gas and bell buoy steer 297° true (**NW** by **W ⅜ W** mag.) for 12 miles to Frying Pan Shoals light vessel. Then steer 290° true (**WNW** mag.) for 7 miles to a position 3 miles southward of Frying Pan Shoals whistling buoy. Then steer 335° true (**NNW** mag.) for 14½ miles, passing 1½ miles westward of Frying Pan Shoals whistling buoy and to the whistling buoy off the entrance of Cape Fear River.

1A. FROM SOUTHWARD.—The principal danger southward of Frying Pan Shoals is the broken ground extending off between Cape

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Romain and Winyah Bay, on which there is a depth of 3¾ fathoms near the wreck lying 11 miles from shore. Deep-draft vessels should pass outside of this broken ground, giving the coast a berth of over 12 miles, and this is the safer course for all vessels at night. When clear of the broken ground the course can be shaped for the whistling buoy off the entrance of Cape Fear River.

Currents.—Except with northeasterly winds, some overrun, probably amounting to 0.5 knot at times, may be expected in approaching from southward. (See currents on pp. 31–32.)

2. Sea to Southport.—The channel over the bar between the bell buoy and nun buoy No. 6 is subject to change, and strangers should be guided by the buoys and range lights. In June, 1913, a 30° true (**NNE** ⅞ **E** mag.) course for 2 miles from the whistling buoy off the entrance of Cape Fear River led to the bell buoy at the entrance; thence a 59° true (**NE** by **E** ½ **E** mag.) course with New Channel range lights in line ahead will lead to the intersection of the Bald Head range. The successive surveys show that the Middle Ground is gradually moving southward and encroaching on the channel marked by the Bald Head range lights, and it may be necessary to keep a little southward of the range from can buoy No. 5 to nun buoy No. 6 in order to keep in the best water.

Above nun buoy No. 6 the chart is a good guide, and the following directions should lead in the best water:

From nun buoy No. 6 steer 32° 30′ true (**NE** ⅞ **N** mag.), following the eastern bank at a distance of ¼ mile until on the Fort Caswell range. Keep northward of the Fort Caswell range between can buoy No. 7 and Fort Caswell. When abreast the wharf at Fort Caswell steer 333° true (**NNW** ⅛ **W** mag.) with Fort Caswell range lights in line astern; Bald Head lighthouse is the rear light of this range. Leave Battery Island light about 250 yards on the starboard hand. Then haul gradually northward and pass the small islet just southward of Southport at a distance of about 300 yards, and the wharves at a distance of about 200 yards.

3. Southport to Reeves Point.—Pass the wharves at Southport at a distance of about 200 yards, pass midway between can buoy No. 7A and a yellow nun buoy, and steer 55° 30′ true (**NE** by **E** ⅛ **E** mag.) with Lower Swash Channel range lights in line ahead until up with nun buoy No. 6A. Above this point the aids marking the edge of the dredged cuts should be passed at a distance of about 200 feet.

From nun buoy No. 6A steer 45° true (**NE** ¼ **E** mag.) for 2¼ miles with Snow Marsh Channel range lights in line ahead. When can buoy No. 13 is abeam steer 24° true (**NNE** ⅜ **E** mag.) with Horseshoe Shoal Channel range lights (Lower Swash Channel front

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in line with Bald Head lighthouse) in line astern, for 1 mile until up with can buoy No. 13A. Then steer 5° true (N 5/8 E mag.) for 1 mile, with Reeves Point Channel range lights in line astern, until abreast nun buoy No. 10.

4. Reeves Point to Campbell Island.—From nun buoy No. 10 steer 14° 30′ true (N by E 1/2 E mag.) for nearly 1 1/2 miles, with Lower Midnight Channel range lights in line ahead, until abreast beacon No. 17. Then steer 359° true (N 1/8 E mag.) for 1 1/2 miles, with Upper Midnight Channel range lights in line astern, until abreast can buoy No. 19.

From can buoy No. 19 steer 347° 30′ true (N 7/8 W mag.) with Orton Cove lower range lights in line astern for nearly 3/4 mile, and leave beacon No. 12 about 250 feet on the starboard hand.

When abreast beacon No. 12 steer 24° true (NNE 3/8 E mag.) with Orton Cove upper range lights in line ahead for 3/4 mile. Pass Orton Point at a distance of about 150 yards and when nearly up to the wharf just above Orton Point steer 13° true (N by E 3/8 E mag.) for 1 1/4 miles, with Lower Liliput Channel range lights in line ahead.

Continue the course until abreast can buoy No. 23 and then steer 352° true (N 1/2 W mag.) for 1 5/8 miles, with Upper Liliput Channel range lights in line astern until abreast nun buoy No. 16A. Then steer 2° 30′ true (N 1/2 E mag.) with Keg Island Channel range lights in line ahead.

5. Campbell Island to Wilmington.—Continue on the Keg Island Channel range, and when beacon No. 25 is abeam steer 332° true (NNW 1/4 W mag.) for 5/8 mile, with Big Island Channel lower range lights in line astern. When beacon No. 25A is abeam steer 307° 30′ true (NW 3/8 W mag.) for 3/8 mile, with Big Island Channel upper range lights in line astern.

Pass between buoy No. 22 and beacon No. 25B and steer 333° true (NNW 1/8 W mag.) for 1 1/2 miles, with Lower Brunswick Channel range lights in line ahead. When buoy No. 26 is abeam steer 11° 30′ true (N by E 1/4 E mag.) for 7/8 mile, with Upper Brunswick Channel range lights in line ahead.

When abreast buoy No. 27 steer 5° true (N 3/4 E mag.) with Fourth Eastern Jetty range lights in line astern for 1 mile, passing about midway between Clarks Island range rear light and Upper Brunswick Channel range rear light. When buoy No. 29 is abeam steer 334° 30′ true (NNW mag.) with Upper Brunswick Channel range rear light astern for 1/4 mile, and when buoy No. 28 is abeam steer 2° true (N 3/8 E mag.) for 7/8 mile, with Clarks Island range lights in line astern.

When buoy No. 30 is abeam steer 18° true (N by E 7/8 E mag.) with Eagle Island light astern for 1 mile, and then follow the wharves on the eastern side of the river at a distance of 50 to 100 yards.

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COAST FROM CAPE FEAR TO WINYAH BAY.[1]

From Cape Fear the coast trends first in a northwesterly direction, then curves gradually westward and southward to the entrance of Winyah Bay. That part of the Atlantic Ocean bordering on this curved coast is known as **Long Bay**. The coast is 80 miles in length between Cape Fear and Georgetown lighthouses, and consists of a sand beach, with numerous small sand hills, separated from the heavily wooded mainland by small streams and marsh; from offshore the woods appear to extend to the water. The coast is clear and 4 fathoms can be taken as close as 1½ miles from the beach; the 10-fathom curve is from 18 to 21 miles offshore, and inside of it the water shoals gradually as the shore is approached. There is no inside passage; there are three inlets, with shifting bars, that can be entered by light-draft vessels with local knowledge.

Western Bar Channel, close to Oak Island at Fort Caswell, is used considerably by small craft from Cape Fear River bound westward along the coast. It is good for about 4½ feet at low tide, but is not buoyed. The best water lies from 100 to 150 yards from shore southward of Fort Caswell, and from there the channel through the shoals trends about 256° true (W by S mag.). Abreast the life-saving station the shore should not be approached closer than ¼ mile.

Lockwoods Folly Inlet is about 11 miles westward of Cape Fear River. The depth on the bar is from 3½ to 4 feet at low tide, and there are no aids; the passage over the bar to the river is said to be difficult. **Lockwoods Folly River** is navigable for a draft of 5 feet at high water for a distance of 18 miles to **Supply** post office. The head of navigation is Lockwoods Folly Bridge, about 4 miles above Supply. The range of the tide is 4½ feet near the inlet and 2 feet at Supply.

Shallotte Inlet, about 18½ miles westward of Cape Fear River, has a depth of about 4 feet at low water on the bar. **Shallotte River** is navigable a distance of 10½ miles to the closed bridge at the town of **Shallotte**; boats without masts might go a few miles farther. Where the river is most obstructed, from 2 to 3½ miles above the inlet, a channel has been dredged along the western bank. There is a depth of 4 feet at low water to Old Sill Landing, and 2 feet in the next 2 miles to Shallotte. The range of tide is about 4½ feet near the inlet and 3 feet at Shallotte.

Little River Inlet, South Carolina, is about 27 miles westward of Cape Fear River. The opening, about 1¼ miles wide between spits, is partly filled by Bird Island, which is ¾ mile wide. The main channel is close westward of Bird Island, and is buoyed; in May, 1912, there was a depth of 8½ feet at low tide on the bar, but there is sometimes much less and the channel is subject also to change in position. Boats up to 7 feet draft go to the wharf at the lower end of **Little River**, a town on the river of the same name about 3½ miles above the entrance. The river is obstructed by shoals and difficult for a distance of 1¼ miles below the wharf to the lower sawmill. The entrance is marked by a prominent, high, white sand dune on **Waiters Island**, on the west side of the inlet.

Myrtle Beach is a summer resort with railroad communication on the beach on the east side at the mouth of **Eight Mile**, or **Wither, Swash**, nearly 20 miles west-

[1] Shown on charts **11**, scale $\frac{1}{400,000}$; **150, 151, 152**, scale $\frac{1}{80,000}$, price of each $0.50.

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southwestward of Little River Inlet and 31½ miles north-northeastward of Georgetown lighthouse.

North Inlet, about 7 miles northward of Georgetown lighthouse, is connected by both **Town Creek** and **Jones Creek** with Winyah Bay; Jones Creek is easier to follow, and is good for 6 feet at high tide. In 1912 there were two inlets at North Inlet, the new one having broken through about ½ mile southward of the old one; at that time both inlets had a depth of about 3 feet at low tide on the bar. The high sand dunes between the two inlets are the most prominent in the vicinity.

Georgetown lighthouse, near the south end of North Island, east side of Winyah Bay, is a white tower and dwelling. The light is fixed white, 85 feet above the water, and visible 15 miles. Storm warnings are displayed near the lighthouse.

Winyah Bay South Jetty light structure is a black, pyramidal, skeleton tower on a mound at the end of the south jetty, entrance of Winyah Bay. The light is flashing white (flash 0.5 second, eclipse 4.5 seconds), 30 feet above the water, and visible 11 miles.

WINYAH BAY[1]

is the first opening of any importance southward of Cape Fear River. Improvements are in progress to obtain a channel 18 feet deep from sea to Georgetown. In 1912 there was a depth of 18 feet or more in the channel over the bar, and inside the bay a channel 15 feet deep had been dredged to Georgetown.

The city of **Georgetown** is situated on the north bank of the Sampit River, just inside its mouth; it has considerable trade in lumber, naval stores, and cotton. The river trade to the Santee, Waccamaw, and Pedee Rivers is considerable.

Waccamaw River empties from northward into Winyah Bay just above Georgetown; it has low-water depths of 12 feet to **Bucksport**, 30 miles; 7 feet to **Conway**, 44 miles; and 3 feet to **Reeves Ferry**, 102 miles. At high-water stages 3 feet can be taken 26 miles farther up the river to **Lake Waccamaw**, the head of navigation. The most important landing is Conway.

Pedee River empties into Winyah Bay just westward of Waccamaw River; it has low-water depths of 9 feet to **Smiths Mills**, 45 miles, and about 3½ feet to **Cheraw**, 145 miles.

Black River empties from northward into Pedee River about 3½ miles above its mouth; it is navigable for river steamers for a distance of 44 miles. **Mingo Creek** empties into Black River, about 22 miles above its mouth; it has a low-water depth of about 8 feet for a distance of 10 miles to **Hemmingway Bridge**, the head of navigation, but there are many sharp bends.

Little Pedee River empties from northward into Pedee River about 30 miles above Winyah Bay and is navigable at high-water stages a distance of 41 miles to **Gallivant Bridge** for vessels of 2½ feet draft. The head of navigation is **Little Rock**, 98 miles above the mouth of the river. At low-water stages the river is nearly dry.

Sampit River is entered from Georgetown Harbor through a dredged channel 200 feet wide and 15 feet deep, which leads through the extensive shoals obstructing the mouth of the river. This channel is to be deepened to 18 feet and widened to 400 feet.

[1] Shown on charts **152, 153**, scale $\frac{1}{80,000}$, price of each $0.50; **428**, scale $\frac{1}{40,000}$, price $0.25.

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The depth in the river channel for a distance of 2½ miles above the dredged cut is 15 feet, and this is the depth abreast the city of Georgetown. The principal landing above Georgetown is **Sampit**, about 10 miles above the mouth of the river.

The **Estherville-Minim Creek Canal**, having a width of 40 to 50 feet and depth of about 6 feet at low water, connects the Santee River with Winyah Bay. The entrance to this canal is about 7 miles below Georgetown and 3 miles above the quarantine station.

Channels.—**South Jetty Channel** parallels the South Jetty for a distance of about 1½ miles to the intersection with the Middle Ground range line and is marked by range lights and buoys. The channel is about 400 feet wide and 18 feet or more deep except near the intersection of the Middle Ground range line, where the depth is about 15 feet.

Middle Ground Channel is a dredged cut about 500 feet wide with a least depth of 15 feet and is marked by range lights and buoys. It leads in a northwesterly direction from the South Jetty Channel to the deep water of the bay.

North Jetty Channel has a least depth of about 9 feet and leads south of the north jetty in a west direction to the Middle Ground range. This channel is not marked and is used only by small local craft.

Western Channel leads along the western side of the bay. It is 280 feet wide and has a least depth of about 15 feet. It is marked on its southwest and west sides by lights which are 250 feet from the middle of the channel. Improvements are in progress to obtain a depth of 18 feet and a width of 400 feet in this channel.

Pilots.—A pilot boat is usually in the vicinity of Georgetown lighthouse and will go outside when signaled. Pilotage is compulsory for certain vessels. For pilot rates see Appendix I.

Towboats are employed by sailing vessels and may be had from Georgetown by making the signal when outside the bar.

Anchorages.—Good anchorage can be found anywhere in the bay between Georgetown lighthouse and South Island light. There is a limited anchorage in the upper part of the bay off the mouth of Sampit River. On account of the limited swinging room only small craft anchor in the Sampit River abreast Georgetown.

Quarantine.—The quarantine boarding station is on South Island on the western side of the bay, about 1⅜ miles above Georgetown lighthouse.

Hospital.—The nearest marine hospital is at Wilmington, N. C. At Georgetown there is a relief station of the United States Public Health Service.

Supplies.—Provisions, some ship-chandler's stores, and fresh water can be obtained at Georgetown.

Repairs.—The nearest place for repairs to vessels or machinery of steamers is at Charleston. There is a marine railway at Georgetown 110 feet long and 22 feet wide. The draft that can be hauled out at high water is 5 feet forward and 9 feet aft.

Storm warnings are displayed at Georgetown lighthouse, South Island, and Georgetown.

Tides.—The mean rise and fall is 3½ feet. High water occurs at Georgetown lighthouse 9 minutes after high water and low water 25 minutes after low water at

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Charleston. At Georgetown high water occurs 1 hour 2 minutes and low water 1 hour 46 minutes later than at Georgetown lighthouse.

Currents.—The tidal currents in Winyah Bay vary in velocity with the state of the rivers emptying into it, as well as with the stage of the tide. Their velocity is greatest between the jetties, where, at strength, it is 2½ to 3½ knots. The set is diagonally across the south jetty. During freshets in the rivers, also with westerly winds, the buoys between the jetties are nearly towed under at times on the ebb. Off South Island the average velocity is from 2 to 2½ knots, increasing somewhat with the springs. Between North and South Islands the set of the flood current is toward Mud Bay until past the north point of the latter, when the set is more westward. Northward of Frazier Point the flood sets into the channel eastward of Hare Island and also into Waccamaw River. In the western channel the current sets generally fair with the course to be steered.

DIRECTIONS, WINYAH BAY AND GEORGETOWN HARBOR.

Note.—The tidal currents have a velocity of about 2 to 3 knots at strength and do not set fair with the channel between the jetties. In a heavy southerly or easterly sea large vessels require careful handling and should take a pilot if one can come out to them. It is advisable for strangers to wait until daylight before entering.

FROM EASTWARD.—From Frying Pan Shoals gas and bell buoy make good a 258° true (**W** ⅞ **S** mag.) course for 75½ miles to Georgetown whistling buoy.

From Frying Pan Shoals light vessel make good a 252° true (**WSW** ⅝ **W** mag.) course for 67 miles to Georgetown whistling buoy.

From Cape Fear River entrance whistling buoy make good a 234° true (**SW** by **W** mag.) course for 62½ miles to Georgetown whistling buoy.

FROM SOUTHWESTWARD.—From Charleston light vessel make good a 59° true (**NE** by **E** ⅜ **E** mag.) course for 28½ miles to a position ½ mile southeastward of Cape Romain whistling buoy and 8½ miles 127° 30′ true (*SE* ⅝ *E* mag.) of Cape Romain lighthouse. Then steer 39° true **NE** ⅜ **N** mag.) for 14 miles; Winyah Bay South Jetty light will then bear 324° true (*NW* by *N* mag.). Then steer 336° true (**NNW** mag.) for 5 miles to the perpendicularly striped nun buoy off the entrance.

FROM SEA TO GEORGETOWN.—From Georgetown whistling buoy steer 254° true (**WSW** ¾ **W** mag.) for 1¾ miles to the perpendicularly striped nun buoy. Then steer 270° true (**W** ⅛ **N** mag.) on the line of the South Jetty channel range lights (white structures). Leave the bell buoy on the port hand and keep a little southward of the range line until up to the middle mound, about ⅝ mile inside the light on the end of the south jetty. Then follow the range closely and when

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the Middle Ground channel range lights (white structures) are in line head up for them on a 311° true (**NW ¼ W** mag.) course. Care should be exercised in making this turn, as the ebb current sets strongly toward the jetty; vessels should not go anything southward or westward of the intersection of the range lines.

Continue on the Middle Ground Channel range until buoy No. 3 is about 200 yards distant ahead, and then steer 340° true (**N by W ⅝ W** mag.) leaving the buoy 50 to 100 yards on the port hand and the shore of North Island about 300 yards on the starboard hand.

When about ¼ mile past Georgetown lighthouse steer about 327° true (**NNW ¾ W** mag.), following the western shore at a distance of about 400 yards. Pass 250 yards northward of South Island light and steer 288° true (**WNW ¼ W** mag.) into the cut, passing 100 feet southward of buoy No. 4. Then be guided by the lights which are about ½ mile apart and mark the southwest side of the dredged channel, 250 feet from its middle. From a position 250 feet eastward of light No. 15 steer 7° true (**N ¾ E** mag.), passing about 100 yards westward of light No. 2. When nearly up to buoy No. 10 steer 27° true (**NNE ½ E** mag.), passing 100 yards westward of it, with light No. 4 a little on the starboard bow.

When the Sampit River range lights (white structures) are in range, bring them astern on a 335° true (**NNW ⅛ W** mag.) course, passing through the dredged cut into the river, and then favor the eastern bank to Georgetown. Vessels should go to the wharves.

Remarks and dangers.—There are no dangers eastward of the entrance. The dangers southward of the entrance are described with the coast from Winyah Bay to Charleston. The south jetty is covered at high water, with the exception of the three mounds on it which are about ⅝ mile apart. Winyah Bay South Jetty light, on the mound at the end of the jetty, and Georgetown lighthouse are described with the coast preceding. The **Middle Ground** is extending seaward, and its eastern end should be given a good berth when off the entrance.

COAST FROM WINYAH BAY TO CHARLESTON HARBOR.[1]

Santee River is one of the largest rivers of South Carolina, and empties into the ocean between Winyah Bay and Cape Romain. There are two mouths, known respectively as North Santee and South Santee; both are obstructed by shifting bars, with little depth, as shown on the chart. Boats enter the river from Winyah Bay through the Estherville-Minim Creek Canal, and the inland passage to Charleston extends westward from the river through Alligator Creek. Santee River is formed by the junction of the **Wateree** and **Congaree Rivers**, 124 miles above its mouth, and is navigable throughout. Wateree River is navigable 58 miles to the town of **Camden**, and Congaree River 44 miles to the town of **Columbia**. The rivers are under improvement by the removal of snags and shoals to maintain a depth of 4 feet at low water to these towns.

[1] Shown on charts **153, 154**, scale $\frac{1}{80,000}$, price of each $0.50.

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East Bank, with 8 feet over it, is the southeasterly end of the shoals, which extend 4 miles from shore southward of the entrance of Winyah Bay. The southeasterly end of the bank is marked by a buoy, which lies nearly 2 miles 170° true (**S ¾ E** mag.) of Winyah Bay South Jetty light.

Between East Bank and Cape Romain, shoals extend 2 to 3 miles from shore; spots with 17 feet over them extend 5¾ miles from shore in one place, the outer one lying 5¾ miles southward of Winyah Bay South Jetty light. Farther out is broken ground with 5 fathoms and less, which extends 12 miles from shore. There is a wreck, marked by a buoy, on one of the shoaler places so far found, lying about 14 miles 92° true (**E ¼ S** mag.) of Cape Romain lighthouse and nearly that distance 159° true (**S by E ¾ E** mag.) of Georgetown lighthouse; there is a depth of 3¾ fathoms northwestward of and near the wreck. This broken ground has not been closely examined, and deep-draft vessels should pass outside of it, giving the coast a berth of over 12 miles.

Cape Romain Shoal extends nearly 4 miles southeastward from Cape Romain, and is marked off its end, where the depth on the shoal is 7 to 10 feet, by a buoy. A red whistling buoy lies 2 miles southeastward of the buoy and 7½ miles 129° true (**SE ⅜ E** mag.) of Cape Romain lighthouse. There is a depth of 4¼ fathoms 1⅜ miles eastward of the whistling buoy.

Cape Romain lighthouse is an octagonal, pyramidal tower, lower half white, upper half faces alternately black and white, and black top. The light is flashing white (light 4.7 seconds, eclipse 55.3 seconds), 154 feet above the water, and visible 19 miles.

Cape Romain Harbor is a good anchorage for small craft inside of Cape Island (Cape Romain). There are two entrances, one from eastward around the north end of Cape Island, with a depth of 4 feet at low water and marked by buoys, and the other from southward, leading westward of Cape Island, with a depth of about 5 feet and not marked. Cape Romain Harbor communicates with the inland passage to Santee River and Winyah Bay eastward, and to Bull Bay and Charleston westward. The harbor is used only by small local craft, and it is not safe for a stranger to attempt to make the anchorage, as the shoals at both entrances are subject to changes. A stranger seeking an anchorage should go to Winyah Bay or Bull Bay. The mean rise and fall of tides is 5 feet.

Bull Bay is broad and shallow, but there is a narrow channel, which is occasionally used as an anchorage, on its southwest side. There is a depth of about 11 feet at low water in the buoyed channel over the bar, and the anchorage is easy of access for sailing vessels in southerly and easterly winds, if the sea is not too heavy. With a smooth sea vessels of 8 feet draft at low water and 12 feet at high water can be taken in to the anchorage. The perpendicularly striped sea buoy lies 3 miles southeastward of the eastern end of Bull Island, the southwestern point at the entrance. From the sea buoy steer 314° true (**NW** mag.) and pass close to buoy No. 2. When a short distance past the latter buoy and the water deepens, steer about 342° true (**N by W ½ W** mag.) to a position nearly ⅜ mile eastward of the east end of Bull Island. Then follow the shore of Bull Island at a distance of about 300 yards, being guided by the lead and the appearance of the shoals. Anchor in the channel when well sheltered from the sea.

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Bull Breakers extend 4¼ miles southward from the shore on the southwest side at the entrance of Bull Bay, and are marked off the southeasterly end by a buoy which lies 5½ miles 168° true (S by E mag.) of the eastern end of Bull Island.

Between Bull Bay and Charleston there are several shoal entrances over shifting bars that are not used.

Isle of Palms is a pleasure resort where the Ferris Wheel is shown on the chart, about 4 miles eastward of the entrance of Charleston Harbor. There is communication by railroad with Mount Pleasant, and thence by ferry to Charleston.

Rattlesnake Shoal lies a little over 3 miles from shore southeastward of Isle of Palms, and east-northeastward of the entrance between the jetties of Charleston Harbor. It is about 2 miles long east and west, has a depth of 6 feet in several places, and is marked by a can buoy at its eastern end and a nun buoy at its western end.

Charleston light vessel is moored in a depth of 6½ fathoms, nearly 5 miles off the ends of the jetties at the entrance of Charleston Harbor. The vessel has a white hull, with "Charleston" on each side, and two masts with lanterns and black oval daymark at head of each. The lights are fixed white, 40 feet above the water, and visible 12 miles. The fog signal is an air chime whistle, blast 3 seconds, silent interval 60 seconds. If the whistle is disabled, a bell will sound 3 strokes in 3 seconds, silent interval 3 seconds, 4 strokes in 4 seconds, silent 50 seconds.

Charleston lighthouse is 4 miles southwestward of the entrance of Charleston Harbor. The structure is a black and white horizontally banded conical tower, black at top. The light is fixed white, 155 feet above the water, and visible 19 miles.

CHARLESTON HARBOR [1]

is 260 miles southwestward of Cape Hatteras and about 65 miles northeastward of Savannah entrance. The harbor is the approach to the city of Charleston and to Cooper and Ashley Rivers; it is easy of access either day or night in clear weather, and is one of the best harbors of refuge on the southern coast. The port has a large foreign and coastwise trade, the principal articles shipped being cotton, lumber, naval stores, and rice.

The entrance is between two converging jetties, which extend nearly 3 miles seaward across the bar. Improvements are in progress to secure a straight channel across the bar, 28 feet deep at low water or 33 feet at high water, with a width of 1,000 feet beyond the jetties and 500 feet between them. In 1913 this channel was nearing completion, the full depth being available on the range line. The channel is marked by Charleston light vessel, range lights, and buoys.

Cooper River enters Charleston Harbor from northward and on the eastern side of the city of Charleston; the navy yard is on its west bank about 6 miles above the customhouse in the city. There are no towns or villages of importance, the principal landings being at lumber mills and phosphate works. The river is navigable for vessels of 26 feet draft to the navy yard and about 7 miles above it; the channel eastward of Drum Island has a depth of about 26 feet at low water, but is very narrow. The channel westward of Drum Island through **Town Creek** is marked by lights and

[1] Shown on charts 154, scale $\frac{1}{80,000}$; 431, scale $\frac{1}{30,000}$; 445, scale $\frac{1}{20,000}$; price of each $0.50.

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is generally used except by large vessels; this channel has a least depth of about 22 feet at its northern entrance. The channel of Cooper River is good for a distance of about 22 miles above the navy yard to where the river forks at what is called the Tee. Vessels have loaded to 15 feet at **Strawberry**, on the western branch just above the Tee; a draft of 7 feet can be taken about 15 miles above the Tee to **Springfield Landing** and 5 feet about 20 miles farther to **Wadboo Bridge**, the head of navigation. A draft of 7 feet can be taken up the eastern branch about 4 miles above the Tee to the chapel, and launches can go about 13 miles farther. Distances given above the Tee are approximate only.

Wando River empties into Cooper River eastward of Drum Island; a draft of 7 feet can be taken to **Wando**, about 12 miles from the customhouse wharf at Charleston, but in places the channel is very narrow; 5 feet can be taken 8 miles farther to **Garon Bridge** (closed), the head of navigation.

Shipyard Creek empties on the west side of Cooper River above Drum Island. There are a number of manufactories on the creek, where vessels load phosphate and lumber. The south entrance, just above Drum Island, has a narrow channel with a depth of about 6 feet at low water, and 13 feet is about the deepest draft now loaded in the creek. Improvements are authorized to dredge a channel 100 feet wide and 15 feet deep through the north entrance, lying ¾ mile above Drum Island.

Ashley River empties into Charleston Harbor from northwestward on the southwest side of Charleston. There are no towns or villages of importance; the principal landings are at numerous phosphate works, all of which have wharves extending to the channel. A depth of about 15 feet can be taken up the river a distance of 5 miles to the phosphate wharves abreast Duck Island; improvements are authorized to dredge a channel 240 feet wide and 20 feet deep up to Standard Wharf, the upper phosphate plant near Duck Island. Above Standard Wharf a least depth of about 7 feet at low water or 13 feet at high water can be taken a distance of about 8 miles to **Lambs**. Above Lambs there is a depth of 7 feet in the channel for a distance of 5 miles and thence 3 feet for a distance of 1½ miles to **Greggs**. **Bacons Bridge** (closed), which is usually considered the head of navigation, is 5½ miles above Greggs. The tides have a range of 5 to 6 feet to Greggs. Three drawbridges with openings 78 to 80 feet wide cross the river; the first is at Charleston about 2 miles above the Battery; the second is the A. C. L. Railroad bridge at **Bees Ferry**; and the third is at **Magnolia Garden**, 1 mile below Lambs. The bridge at Bees Ferry requires caution when passing up the river on the ebb current, which sets across the end of the draw; vessels can pass on either side of the draw pier.

Wappoo Creek, on the west side of Ashley River 1¼ miles above the Battery, is the entrance to the inland passage leading southward.

Charleston is situated at the head of the harbor at the confluence of the Cooper and Ashley Rivers. The principal wharves are on the eastern water front of the city extending along the west bank of Cooper River. The distance from the ends of the jetties to the city wharves is between 7 and 8 miles.

Anchorages.—On account of submarine cables vessels are cautioned not to anchor northeastward of Fort Sumter, between it and Sullivan Island. Vessels are not permitted to anchor in the stream opposite the eastern part of the city, except north-

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eastward of Merchants Wharf (Hazel Street) and southeastward of the southernmost wharves, and must anchor so as to give the wharves a berth of not less than 200 yards when tailing toward them. **Lower Anchorage** has good holding ground, but is somewhat exposed to southeast winds; this also applies to the anchorage southeastward of the city. The best anchorage is in the mouth of Cooper River about 1 mile above the city. The **quarantine anchorage** is on the south side of South Channel abreast Fort Johnson and is marked by two yellow buoys. The anchorage and berthing of vessels is under the control and supervision of the harbor master, and masters are required to report to him within 24 hours after arrival.

Quarantine.—Vessels subject to visitation by the health officer will be boarded when off the quarantine anchorage at Fort Johnson.

Pilots will be found cruising outside the bar; the limit of their cruising ground is 30 miles from the entrance. Pilotage is compulsory for certain vessels. For pilot rates see Appendix I. Vessels desiring a pilot and not having obtained one, can anchor about 2 miles northwestward of the light vessel until boarded by one. Pilots for the Inland Passage can be obtained in Charleston.

Towboats will sometimes be found cruising outside the bar; the deeper draft sailing vessels tow in and out. All seagoing sailing vessels bound into Cooper and Ashley Rivers employ towboats either outside the bar or at Charleston. Towboats can always be had by making signal while outside the bar, at the wharves, or may be ordered from the towboat offices in the city.

Wharves.—At most of the wharves deep-draft vessels lie aground in the soft mud at low water. The regulations in regard to fires on board vessels lying at the cotton wharves are very strict. For harbor fees, see Appendix I.

Supplies.—Coal, either anthracite or bituminous, in large quantities for steamers, can be had alongside the wharves or from lighters in the stream. Water can be had alongside the wharves or from water boats. Provisions and ship chandler's stores can be obtained in the city.

Repairs to machinery of steamers and to hulls of vessels can be made; there is a marine railway here capable of hauling out a vessel of about 600 tons and 170 feet in length.

Storm warnings are made from the customhouse at Charleston and at Moultrieville.

United States Public Health Service.—Medical attendance is furnished by a medical officer of the service. Seamen requiring long-continued hospital treatment are sent to the marine hospital at Wilmington, N. C.; for short terms of hospital treatment they are sent to one of the hospitals in the city.

Tides.—See the tide tables for the Atlantic coast of the United States, in which the tides are predicted for every day at Charleston. At Fort Sumter high and low water occur 9m. and 25m., respectively, earlier than at Charleston. The mean range at Fort Sumter is 5 feet.

The **tidal currents** off the entrance are revolving (see the results of the observations at Charleston light vessel on p. 32).

The tidal currents between the jetties and in Charleston Harbor generally set fair with the channel near its axis. At a point about 1 mile outside Fort Sumter, branches from the main ebb current set through the openings between the jetties and the shore

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with a velocity of about 2 knots at strength. The maximum observed velocities at the strength of the ebb are about 2 knots between the jetties, 3 knots between Fort Sumter and Fort Moultrie, and 2 knots in the South Channel and off the eastern front of Charleston; the velocity of the flood current is less than the ebb, depending on the freshet flow from the rivers. Slack water occurs between the jetties at about the time of high and low water at Charleston, and between Fort Sumter and Fort Moultrie 30 minutes, and South Channel 1 hour 10 minutes, after high and low water at Charleston.

DIRECTIONS, CHARLESTON HARBOR.

FROM NORTHWARD.—The safer course, and the one generally used by large, deep-draft vessels, is to pass outside of Frying Pan Shoals gas and bell buoy. From Cape Lookout Shoals light vessel a 230° true (**SW ¾ W** mag.) course for 78 miles will lead to Frying Pan Shoals gas and bell buoy, or a 237° true (**SW** by **W ⅜ W** mag.) course made good for 84 miles will lead to Frying Pan Shoals light vessel.

From Frying Pan Shoals gas and bell buoy make good a 244° true (**SW** by **W ⅞ W** mag.) course for 90 miles; or, from Frying Pan Shoals light vessel make good a 237° true (**SW** by **W ¼ W** mag.) course for 83 miles. Either course should lead in a least depth of about 12 fathoms to a position with Cape Romain lighthouse bearing 325° true (*N W* by *N* mag.) distant 16 miles. The only danger is the broken ground extending off between Winyah Bay and Cape Romain, on which there is a depth of 3¾ fathoms near the wreck lying 11 miles from shore.

From this position a 251° true (**WSW ⅜ W** mag.) course made good for 25 miles should lead to a position 3 miles east-southeastward of Charleston light vessel. If uncertain of the position keep in a depth of over 8 fathoms until the light vessel is sighted. The dangers between Winyah Bay and Charleston are described with the coast preceding.

FROM SOUTHWARD.—From a position 2 miles southeastward of Martins Industry light vessel a 48° true (**NE ⅜ E** mag.) course made good for 51 miles will lead in a least depth of about 7 fathoms to a position 2 miles southeastward of Charleston light vessel.

From Charleston light vessel steer 299° true (**NW** by **W ⅜ W** mag.) on the Main Channel range (Fort Sumter lighthouse in line with St. Philips Church spire), and pass midway between the buoys which mark the sides of the dredged channel until nearly 2 miles inside the ends of the jetties and up to the intersection with the Mount Pleasant range line. *Fort Sumter light* is on a skeleton structure at the end of a short foot bridge close to the north side of Fort Sumter; the latter is a stone structure.

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Leave gas buoy No. 17 about 200 feet on the port hand and steer 317° true (**NW ¼ N** mag.) with the *Mount Pleasant range* lights (pyramidal, slatted structures; front one black, rear one white) in line ahead, until abreast Fort Sumter and up to the intersection with the South Channel range line. After leaving the Main Channel range the channel widens and so continues to Charleston, the principal dangers being marked by buoys. The Mount Pleasant range is hard to pick up except in clear weather.

Steer 270° true (**W ⅛ N** mag.) with *South Channel range* lights (black structures with white daymarks) in line ahead until about ¼ mile past Fort Ripley Shoal (Middle Ground) lighthouse. Then haul northwestward, leave gas buoy No. 10 about 100 yards on the starboard hand, steer 337° true (**NNW** mag.), and then follow the wharves at a distance of ¼ mile or less. See Anchorages in the description preceding.

STONO INLET [1]

is about 7 miles southwestward of Charleston lighthouse. The entrance of the inlet is obstructed by a shifting bar which extends 2¼ miles seaward and usually has about 7 feet in the channel across it. A sea buoy marks the entrance. Otherwise there are no aids and the inlet is not used. Inside the bar the depth in the inlet ranges from 3 to 7 fathoms.

Stono River empties into the inlet from northward, about 1¾ miles above the entrance. On the west bank of the river, 3¼ miles above the entrance of the inlet, is the village of **Legareville**. The river is of no importance except for its phosphate rock, which is shipped from Charleston. Its upper reach, above Elliott Cut, forms part of the inland passage from Charleston to Savannah. Vessels enter the river by the inside route from Charleston.

NORTH EDISTO RIVER.[2]

The entrance to this river is 17 miles southwestward of Charleston lighthouse and 17 miles northeastward of Hunting Island lighthouse. It is of little commercial importance and rarely used. Shoals extend offshore nearly 3 miles at the entrance of the river, forming a shifting bar, over which there is a channel depth of about 10 feet. This channel is marked by buoys which are moved, when practicable, to indicate the best water. Pilots can be obtained at Charleston. Two of the tributaries of North Edisto River, Wadmelaw River from eastward and Dawho River from westward, are part of the inland passage from Charleston to Savannah. **Rockville** is a village on Bohicket Creek, 2 miles above the entrance of North Edisto River.

The mean rise and fall of tides is 5.8 feet. On the bar the direction of the current is generally across the channel. The flood current sets about southwestward and the ebb east-northeastward, and both have considerable velocity. Inside the bar, in the channel between the breakers, the ebb current is to be guarded against, particularly as it sets across the north breakers.

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[1] Shown on chart 154, scale $\frac{1}{80,000}$, price $0.50.

[2] Shown on charts 154, scale $\frac{1}{80,000}$, price $0.50; 434, scale $\frac{1}{50,000}$, price $0.20.

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SOUTH EDISTO RIVER[1]

empties into the Atlantic about 8 miles northeastward of Hunting Island lighthouse and just eastward of St. Helena Sound entrance. The river is of little commercial importance, but it is navigable for flatboats and rafts for a distance of about 220 miles above its mouth. From the entrance to Dawho River it is known as South Edisto and above Dawho River it is known as **Edisto River.** The stretch of the river between Fenwick Island Cut and Dawho River forms part of the inland passage from Charleston to Savannah. Near the junction of Dawho and Edisto Rivers the water is generally fresh and suitable for boilers. **Jacksonboro** is a village on the railroad about 33 miles above the mouth of the river, to which point a draft of 7 feet can be taken at high water.

The entrance of the river is obstructed by a shifting bar which forms a part of the extensive shoal which makes offshore for a distance of about 6 miles from the entrance to St. Helena Sound. The depth through the buoyed channel into South Edisto River is from 9 to 11 feet, and the buoys are moved to indicate the best water. The river is entered by way of the inside route, and the entrance from sea is not used. Pilots for the bar and river may be obtained from Charleston or Beaufort, S. C. The mean rise and fall of tides is 6 feet.

ST. HELENA SOUND[2]

is the broadest opening in the coast between Chesapeake entrance and the Gulf of Mexico. From Bay Point on the east to Hunting Island on the west the entrance is 6½ miles wide. About 1¾ miles from the northern end of Hunting Island is Hunting Island lighthouse, the principal guide to the entrance. Shoals make off for a distance of 6 miles seaward from the entrance, through which there are several channels leading into the sound. The principal channel has a depth ranging from 12 to 15 feet, and is marked by buoys which are moved to indicate the best water. In 1912 there was a depth of about 14 feet, and vessels of 18 feet draft were taken out at high water with a smooth sea.

Hunting Island lighthouse is a conical tower, lower part white, upper part black. The light is flashing white (light 4.5 seconds, eclipse 25.5 seconds), 133 feet above the water, and visible 18 miles.

A number of navigable rivers empty into the sound, the most important of which are Coosaw, Ashepoo, Bull, Combahee, Morgan, and Harbor Rivers. Ashepoo and Coosaw Rivers and Brickyard Creek are a part of the principal inland passage from Charleston to Savannah.

Coosaw River empties into the head of the sound about 5 miles above its entrance. It is important only as a part of the inside passage. The channel in the river is irregular in depth, having been made so partly by the phosphate dredges. It is buoyed for a distance of about 10 miles to the mouth of Brickyard Creek, and a depth of 15 feet can be taken to this point at high water. **Brickyard Creek** connects Coosaw and Beaufort

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[1] Shown on charts **154**, scale $\frac{1}{80,000}$, price $0.50; and entrance **436**, scale $\frac{1}{40,000}$, price $0.25.

[2] Shown on charts **154**, scale $\frac{1}{80,000}$, price $0.50; **436**, scale $\frac{1}{40,000}$, price $0.25; **435**, Bull and Combahee Rivers, scale $\frac{1}{40,000}$, price $0.20; **437**, Brickyard Creek, scale $\frac{1}{40,000}$, price $0.25.

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Rivers and has a least depth of 7 feet. **Whale Branch** connects Coosaw and Broad Rivers and has a least depth of about 5 feet. Two draw bridges cross the branch about 4½ and 5½ miles westward of the entrance to Brickyard Creek.

Bull River empties into Coosaw River from northward about 5 miles above its mouth. There is a large phosphate plant and wharf, with 21 feet at its end, on the west bank of the river about 2 miles above its mouth, and there is a least depth of about 17 feet in the river to it. Opposite the phosphate plant and just inside the mouth of a creek is a National quarantine station. **Chisolm** is a small settlement on the west bank of the river about 3½ miles above its mouth; some provisions, gasoline, and water can be obtained in case of necessity. **Williman Creek** has a depth of about 5 feet around the north side of Williman Island. **North Wimbe Creek**, southward of Williman Island, is nearly dry in places at low water.

Combahee River empties into Coosaw River from northward about 2 miles above its mouth. The river is unobstructed for a distance of 52 miles above its mouth to the A. C. L. Railroad bridge (closed), and is navigable for this distance by boats of about 5 feet draft; the tides have a range of about 6 feet at the mouth of the river and 2.5 feet at the bridge, and are felt for about 18 miles above the bridge.

Old Cheehaw Creek empties into Combahee River about 3 miles above its mouth; about 1 mile above the junction of Old and New Cheehaw Creeks is a large sawmill at the village of Wiggins. **Wiggins** has railroad and telephone communication, and some provisions can be obtained. The deepest draft loaded at the mill is about 15 feet. A towboat is stationed here.

New Cheehaw Creek empties into Combahee River at its mouth; it is unimportant and has no traffic.

Ashepoo River empties into St. Helena Sound from southward just inside the entrance; for a distance of 2¾ miles above the entrance to Fenwick Island Cut the river forms part of the inland passage between Charleston and Savannah. At high water a draft of about 6 feet can be taken approximately 39 miles above the entrance to the A. C. L. Railroad drawbridge, and boats have gone to within 8 miles of the town of **Walterboro**. There are no settlements of any importance on the river.

Morgan River empties into St. Helena Sound from westward. It is about 9 miles long and at its head connects with Chowan Creek, a tributary of Beaufort River; at the divide this passage is nearly dry at low water. The best entrance to Morgan River is through **Parrott Creek**, which has a depth of 13 to 14 feet and leads from Coosaw River nearly opposite the mouth of Bull River. There is also an entrance with a depth of 8 feet, through **Lucy Point Creek**, also known as **Dales Creek**. Vessels going to the former phosphate plant on Lucy Point Creek, entered at high water from Coosaw River drawing 12 feet or less, and left by way of Morgan River and Parrott Creek drawing 15 feet.

Harbor River empties into St. Helena Sound from southwestward. At its head the river connects with **Story River** and the latter with **Station Creek**, forming an inland waterway with a least depth of about 4 feet, from St. Helena Sound to Port Royal Sound; but this passage is rarely used.

Pilots for the sound can be had by writing or wiring to Beaufort, S. C.; Charleston pilots will sometimes take vessels into the sound. Pilotage is compulsory for certain vessels. For pilot rates see Appendix I.

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Towboats.—There is a towboat at Wiggins. Vessels sometimes tow to St. Helena Sound from Charleston and Savannah.

Tides.—The mean rise and fall of tides on the bar and entrance to St. Helena Sound is 6 feet.

DIRECTIONS, ST. HELENA SOUND.

From Charleston light vessel a 235° true (**SW** by **W** mag.) course made good for 34 miles will lead in a least depth of about 4 fathoms to the Sea buoy off the entrance of St. Helena Sound. From Martins Industry light vessel make good a 36° true (**NE** ¾ **N** mag.) course for 15¾ miles, and then steer 359° true (**N** mag.) for about 2½ miles to the Sea buoy.

The channel between the shoals from the entrance of St. Helena Sound out to the bar has maintained about the same position since the first survey was made in 1857, the channel on the bar having moved southward nearly 1 mile since that date. The depths on the bar have been from 12 to 15 feet. With the aid of the chart vessels of about 12 feet draft, with a rising tide and a smooth sea, should have no difficulty in entering by following the buoys. The depths, especially on the crest of the bar, are subject to frequent change, and local knowledge is required to carry the best water. Hunting Island lighthouse and the buoys are the only aids for the bar. The buoys are moved as necessary to mark the channel. The Sea buoy off the entrance is a perpendicularly striped whistling buoy, located in a depth of about 5 fathoms about 7 or 8 miles from Hunting Island lighthouse. A 278° true (**W** ¾ **N** mag.) course for the lighthouse will lead sufficiently close to the Sea buoy to see it in clear weather; vessels should keep in a low water depth of over 5 fathoms until the Sea buoy is sighted.

Follow the buoyed channel across the bar until up with can buoy No. 3, with Hunting Island lighthouse bearing 225° true (*SW* mag.). Pass 200 yards northeastward of this buoy and steer 309° true (**NW** ½ **W** mag.) for Combahee Bank beacon (slatted structure) until up with the perpendicular-striped buoy lying 1⅝ miles from the beacon. Above this buoy anchorage can be selected in the channel of St. Helena Sound and Coosaw River.

From the perpendicularly striped buoy steer 298° true (**NW** by **W** ½ **W** mag.), pass nearly ⅜ mile southward of Combahee Bank beacon, and pass can buoy No. 5 PB and nun buoy No. 4 at a distance of about 300 yards. From the latter buoy steer 307° true (**NW** ⅝ **W** mag.), leave can buoy No. 7 200 to 300 yards on the port hand, and follow the north bank at a distance of 300 yards to the horizontally striped buoy at the entrance of Combahee River.

The passage to Wiggins leads up Combahee River nearly 4 miles above this buoy and then up Old Cheehaw Creek, but sailing vessels

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require a towboat for this part of the route and strangers should take it on a rising tide. There is scant room for anchorage in Combahee River, and none in Old Cheehaw Creek. Leave the horizontally striped buoy at the entrance of Combahee River on the port hand and follow the east bank at a distance of 300 to 400 yards to buoy No. 1. Leave this buoy on the port hand, and then follow the bight in the west bank at a distance of about 100 yards to buoy No. 3. Leave this buoy 75 yards on the port hand, steer 340° true (N by W ¾ W mag.) for 1½ miles, and pass 100 yards off the point on the west bank. Then haul up for the buoy at the entrance of Old Cheehaw Creek. Small steamers of less than 9 feet draft should have no difficulty in going up Old Cheehaw Creek to Wiggins on a rising tide; the channel follows the ebb-tide bends, favors the bight in the west bank in passing the mouth of New Cheehaw Creek, and then favors the south bank in passing the point of woods just above.

Bound to Bull River.—Pass ⅜ mile southward of the horizontally striped buoy at the entrance of Combahee River, steer 275° true W ½ N mag.) for the entrance of Bull River, and pass 300 to 500 yards off the south bank (north end of Morgan Island). Leave the horizontally striped buoy at the entrance of Bull River about 150 yards on the port hand, favor the south bank at the entrance of the river, then follow the east bank at a distance of 200 yards for 1 mile until up with the point on the west bank ½ mile below the wharf at the phosphate plant, and then follow the west bank to the wharf.

PORT ROYAL SOUND[1]

is the largest and best unimproved harbor on the coast of South Carolina; between Bay Point on the northeast and Hilton Head on the southwest the entrance is about 2 miles wide. Shoals extend 8 miles in a general south-southeast direction from the entrance, forming a bar at the outer part, through which there are two channels. Southeast Channel is the principal one, and is marked by Hilton Head range lights (white structures) and buoys, and in May, 1912, had a least depth of about 21 feet. South Channel is not marked and in 1912 was not used.

Martins Industry light vessel is moored in a depth of 52 feet, on the Hilton Head range, 13¼ miles 104° true (ESE ¾ E mag.) of the front light. The vessel has a red hull, with "Martins Industry" on each side, and two masts with lanterns and circular cagework daymarks at head of each. A fixed white light is shown from the foremast and a fixed red light from the mainmast, each 44 feet above the water, and visible 12 miles. The fog signal is a steam whistle, blast 2 seconds, silent interval 18 seconds. If the whistle is disabled a bell will be struck by hand a double blow every 20 seconds. The submarine bell strikes "2," thus: 2 strokes in 2 seconds, silent 20 seconds.

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[1] Shown on charts 155, scale $\frac{1}{80,000}$, 571, scale $\frac{1}{40,000}$, price of each $0.50; 437, 438, scale $\frac{1}{40,000}$, price of each $0.25.

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Beaufort River is the approach to Beaufort, Port Royal, and the United States Naval Station, and with Brickyard Creek forms a part of the principal inland passage. Beaufort is about 10 miles above the mouth of the river; it has a little trade and can be reached at high water by vessels of 18 feet draft; there are depths of 12 to 14 feet alongside the wharves. **Station Creek** empties into Beaufort River from eastward at its mouth; with Story and Harbor Rivers it forms an inland passage, with a least depth of about 4 feet, between Port Royal Sound and St. Helena Sound. **Chowan Creek (Johnsons River)** empties into Beaufort River from eastward 5 miles above Bay Point, and at its head connects with Morgan River; at the divide this passage is nearly dry at low water, but at high water it can be used by light-draft boats in going to St. Helena Sound. **Battery Creek** empties into Beaufort River 7 miles above Bay Point; just inside its entrance is the town of Port Royal, a railroad terminus. There is a depth of 20 feet or more at one of the wharves, but there is no trade. **Archers Creek** is a narrow passage leading westward from the mouth of Battery Creek to Broad River; improvements are authorized to dredge a channel 75 feet wide and 6 feet deep through the creek.

Broad River extends northwestward from the head of Port Royal Sound, and is about 16 miles long; with the aid of the chart it is not difficult to Whale Branch. **Pocotaligo, Tulifiny,** and **Coosawhatchie Rivers** empty into the head of Broad River; these rivers are said to have a depth of about 1½ feet at low water to the closed highway bridges which cross them below the A. C. L. Railroad.

Chechessee River empties into the head of Port Royal Sound from westward; **Colleton River,** one of its tributaries, is of little importance, but has a good channel for a distance of 5 miles. A depth of 24 feet can be taken up the Chechessee to the mouth of the Colleton River, and 20 feet up the latter for a distance of 5 miles. These rivers are of no commercial importance.

Skull Creek enters Port Royal Sound from southwestward about 4 miles above Hilton Head. The creek forms part of the inland passage to Savannah.

Anchorages.—The usual and best anchorage is in the mouth of Beaufort River, abreast the mouth of Station Creek; southward of Bay Point the holding ground is poor. There is good anchorage, with a depth of about 4 fathoms, in the channel of Beaufort River from a short distance below the Quarantine Station to a short distance above the Naval Station. Vessels should not anchor on the Paris Island range. The sound is sometimes used as a harbor of refuge in winter.

Quarantine.—The national quarantine station is on the west bank of Beaufort River 5 miles above Bay Point.

Pilots.—Licensed pilots cruise off the bar when a vessel is expected. If a pilot is not obtained outside, the vessel may come to anchor off the sea buoy with the pilot signal set until she is boarded by one. Pilotage is compulsory for certain vessels. For pilot rates see Appendix I.

Towboats.—Sailing vessels seldom employ towboats either over the bar or in Beaufort River. Towboats can be had at Charleston or Savannah.

Supplies.—Water and coal can be had alongside the wharves at Port Royal, and provisions, water, and gasoline at Beaufort.

Repairs.—The nearest place where a vessel can be hauled out is Savannah.

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Hospital.—At Beaufort there is a relief station of the United States Public Health Service.

Tides.—The mean rise and fall of tides on the bar is 6.4 feet, and at Beaufort, 7.3 feet.

Currents.—The currents on the bar have an estimated velocity of 1½ knots, and set fair with the channel. The currents in the sound have a velocity of possibly 2 knots or more at times, and the rips on Fishing Rip and Middle Shoal have the appearance of breakers at times.

DIRECTIONS, PORT ROYAL SOUND.

The channel between the shoals from the entrance of Port Royal Sound out to the bar has maintained its position practically without change since the first survey was made in 1856, the only change noted having occurred on the bar or in its vicinity. On the bar, Northeast Breakers and Southeast Channel have moved bodily southward nearly 1 mile since that date, the succeeding surveys showing a fairly uniform rate of movement of 100 feet per year. The depths on the bar range from 18 to 22 feet. As the depths on the crest of the bar are subject to frequent change, local knowledge is required to carry the best water, which was 21 feet in 1912. With the aid of the chart, vessels of about 15 feet draft, with a rising tide and a smooth sea, should have no difficulty in entering during daylight by following the buoys. Martins Industry light vessel, the range lights, and buoys are the guides. The boiler of a wreck, shown on the chart nearly 5 miles southeastward of Bay Point, is a permanent mark and can be used for cross bearings.

Approaching from any direction, shape the course for Martins Industry light vessel, and from it steer 284° true (**WNW ¾ W** mag.) on the Hilton Head range until up with the outer buoys off the bar. Follow the buoyed channel across the bar, giving the red bell buoy at the southwest end of Northeast Breakers a berth of over 100 yards in rounding it. When past the black buoy, lying 1 mile north-northwestward of the bell buoy, steer 335° true (**NNW ¼ W** mag.), and keep on or a little eastward of the Paris Island range line until past Fishing Rip, and then follow the range or keep a little westward of it until past Bay Point.

To go up Beaufort River, when about 1 mile past Bay Point steer 8° true (**N ¾ E** mag.) and pass about 150 yards eastward of buoys Nos. 7 and 9. When the wharf on the eastern bank is abeam steer 346° true (**N by W ¼ W** mag.) to a position about 100 yards westward of buoy No. 6. Then steer 333° true (**NNW ⅜ W** mag.) for the turning point on the eastern bank until abreast the naval station, and then steer 324° true (**NW ⅞ N** mag.). Round the point on the eastern bank at a distance of about 300 yards and steer 7° true (**N ⅝ E** mag.) for the low grassy point on the eastern bank. Give

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the first point on the west bank above Battery Creek a berth of about 300 yards, and then keep in midriver until past buoy No. 13. Then follow the west bank at a distance of about 200 yards, pass about 100 yards westward of buoy No. 10, pass 200 yards off the next point on the south bank, and anchor in midstream, keeping the easternmost wharves at Beaufort bearing eastward of 0° true (*N* mag.).

CALIBOGUE SOUND.[1]

The entrance to this sound lies 11 miles southwestward of Port Royal Sound entrance and 5 miles northward of Tybee lighthouse; it is obstructed by shifting shoals through which there are several unmarked crooked channels. From sea the best way of entering the sound is from Tybee Roads and the depth that can be taken over the bar at low water is about 9 feet. Above the bar the depths are ample. These waters are a part of the inland passage from Charleston to Savannah, and otherwise are of little importance.

May River, which empties into the sound from westward about 5½ miles above the entrance, is the approach to the village of **Bluffton**, situated about 7 miles above its mouth. There is a depth of 9 feet at low water to the town by entering May River through Tybee Roads and Calibogue Sound, 12 feet or more by way of Port Royal Sound and Skull Creek, and 6 feet from Savannah through the passage by way of Mud River and Ramshorn Creek.

Cooper River empties into the sound from westward about 2¼ miles above the entrance. This river is only important as a part of the inland passage to Savannah which leads through Ramshorn Creek from Cooper River.

Mackays Creek enters the sound from northward at its junction with Skull Creek, the latter connects with Port Royal Sound and forms part of the inland passage.

On the south side of the entrance to Cooper River are the **Daufuskie Island range** lights (white structures) for entering the sound from Tybee Roads.

DIRECTIONS, CALIBOGUE SOUND.

From Tybee Roads steer 321° true (**NW ½ N** mag.) on the Bloody Point range for about 1 mile past bell buoy No. 13; or, coming down Savannah River, pass about ¼ mile southward and eastward of Bloody Point Spit buoy (can, No. 1). Then steer 3° true (**N ¼ E** mag.), leaving nun buoy No. 2 about ¼ mile on the starboard hand and can buoy No. 3 about 150 yards on the port hand. Then steer 354° true (**N ½ W** mag.), with Daufuskie Island range lights (white structures) in line ahead, into the sound.

[1] Shown on chart **155**, scale $\frac{1}{80,000}$, and in part on chart **571**, scale $\frac{1}{40,000}$, price of each **$0.50**.

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TYBEE ROADS AND SAVANNAH RIVER.[1]

Tybee Roads is the name applied to an anchorage surrounded by the shoals which lie off the entrance to Calibogue Sound and Savannah River, eastward of the northeastern end of Tybee Island. This anchorage can be entered either in the daytime or at night; its general depth is 19 to 23 feet and the shoals assist to break the sea from any direction. There are two good channels leading across the bar off the roads, the North Slue Channel with 15 feet and the Main Channel with 24 feet; both of these channels are marked by buoys and the Main Channel by a number of ranges which are easily followed. The main channel over the bar is being improved by dredging.

Tybee lighthouse, on the north end of Tybee Island, is an octagonal brick tower, lower part black, upper part white. The light is fixed white, 144 feet above the water, and visible 18 miles.

Savannah River forms the boundary between the States of South Carolina and Georgia, and is navigable during the greater part of the year for steamers of 5 feet draft to the city of **Augusta**, a distance of about 176 miles above Savannah; flatboats can be taken up the river about 3 miles farther. Between Savannah and Augusta there are numerous landings, but no towns or villages of importance; several bridges with draws about 60 feet wide cross the river below Augusta. There is a dam 8 miles above Augusta; pole boats go from Augusta to the river above the dam through a canal, and the river is navigable for this class of boats from the dam to **Petersburg**, a distance of 43 miles.

From its entrance to the S. A. L. Railroad, in the upper part of Savannah, the river is being improved to obtain a depth of 26 feet at low water. The channel is 500 feet wide from sea to Fort Pulaski, and thence to Savannah 400 to 600 feet wide, with wing dams and jetties on both sides; at present (1912) it has a least depth of 24 feet at low water from sea to the city; it is marked by buoys and range lights, but strangers of over 15 feet draft and sailing vessels should always employ a pilot when entering the river. The deepest draft taken out of the river and over the bar in 1912 was 29½ feet.

Savannah is on the south bank of the river about 15 miles above the entrance; it is the chief port of the State of Georgia and one of the important southern ports for the shipment of cotton, lumber, and naval stores. There is sufficient water at the wharves for vessels that are brought to the city.

Anchorages.—The usual anchorage for vessels waiting for a favorable tide to go up the river is in Tybee Roads, about 2 miles eastward of Tybee lighthouse, or outside the bar near Tybee gas and whistling buoy. The holding ground is good at both anchorages, but 22 feet is about the greatest depth available in the roads. Vessels rarely anchor in the river as there is no room for large vessels to swing; in case of necessity there is a small anchorage off Fort Jackson, about 2 miles below the city.

A **Branch Hydrographic Office** of the Navy Department is located at the customhouse; this office is supplied with the latest information and publications affecting navigation for the consultation of mariners.

Quarantine.—The national quarantine station and boarding station is on the south side of the channel west of Cockspur Island.

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[1] Shown on charts 155, scale $\frac{1}{80,000}$; 440, scale $\frac{1}{40,000}$; price of each $0.50.

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Hospital.—At Savannah there is a relief station of the U. S. Public Health Service.

Pilots.—A pilot boat will be found outside the bar. Pilotage is compulsory for certain vessels. For pilot rates see Appendix I.

The **Harbor Master** has charge of the berthing of vessels. The limit of speed of steamers passing the wharves is 4 miles an hour, and the engines must be stopped when passing where two or more vessels are moored abreast. Steamers must be slowed and, where necessary, engine stopped in passing dredges at work in the river.

Towboats will come out over the bar to vessels making signal; one may usually be found cruising outside the bar. With a fair wind sailing vessels usually sail into the roads, but a towboat is necessary for large sailing vessels between the roads and Savannah.

Supplies.—Coal, either anthracite or bituminous, in large quantities, can be had at the wharves at Savannah, or from lighters towed down to vessels at the roads. Fresh water is usually brought to shipping by tugs; the river water at Savannah is fresh at any stage of the tide. Provisions and ship chandler's stores can be had in the city or are sent down to the roads in tugs.

Repairs.—The facilities for repairs to the machinery of steamers are good. There are several marine railways; the largest will haul out vessels of 1,000 tons with a draft of 8 feet forward and 12 feet aft.

Storm warnings are displayed at Savannah and at the Martello Tower at Tybee Island.

Tides.—For tidal data at Savannah River entrance (Tybee lighthouse) see the tide tables for the Atlantic coast of the United States, published annually in advance by the Coast and Geodetic Survey, in which the tides are predicted for every day of the current year. On the bar high and low waters occur about 30 minutes before high and low waters, respectively, at Tybee lighthouse. At Savannah high water occurs 1h. 3m. and low water 2h. 3m. after high and low water, respectively, at Tybee lighthouse. The mean durations of rise and fall of the tide are 6h. 6m. and 6h. 19m. at Tybee lighthouse, and 5h. 7m. and 7h. 18m. at Savannah.

The mean rise and fall of tides at Tybee lighthouse is 6.8 feet and at Savannah 6 feet. At Purysburg, 20 miles above Savannah, the mean rise and fall of tides is a little less than 1 foot; when the river is low the tides are felt possibly 7 miles above Purysburg, while during heavy freshets the rise and fall at Cross Tides, 3½ miles above Savannah, is 2 feet or less.

Currents.—The mean velocity at the strength of the ebb current is 2.75 knots between the training walls at the entrance, 2.4 knots below Venus Point, 1.75 knots at The Bight, and 1.1 knots (estimated) at Savannah; the flood current has a velocity about one-fourth less than the ebb current in the lower part of the river, and about one-half less at Savannah. From the entrance nearly to Savannah slack water occurs about 1 hour after high and low water stand; in the vicinity of the entrance near Tybee lighthouse, therefore, slack water occurs about 1 hour after high and low water at the lighthouse, and at Savannah slack water occurs about 1½ hours and 2½ hours after high and low water, respectively, at Tybee lighthouse. The time of slack water is considerably influenced by the wind and freshets.

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The currents set in the direction of the channel except at the entrance near Tybee lighthouse, where the flood sets northwestward across the channel.

Freshets occasionally occur in the spring, but do not endanger the shipping at the wharves at Savannah.

DIRECTIONS, SAVANNAH RIVER.

The channel from sea to Savannah is a dredged cut from 400 to 600 feet wide, the tidal currents have considerable velocity, and strangers are advised to take a pilot. The ranges mentioned in the following directions mark the axis of the cut; in addition to the ranges, the channel is buoyed. Vessels waiting for the tide when in the river formerly made fast to the old mooring wharves at Venus Point and The Bight, but the depth in the channel is now sufficient to make it unnecessary; in 1912 these wharves were in bad repair.

FROM NORTHWARD shape the course for Martins Industry light vessel, from which a 240° true (**SW** by **W** ⅜ **W** mag.) course for 15½ miles will lead to Tybee gas and whistling buoy.

FROM SOUTHWARD deep-draft vessels should not shoal the water to less than 7 fathoms. From Brunswick light vessel make good a 22° true (**NNE** mag.) course for 61½ miles to a position 2 miles southeastward of Tybee gas and whistling buoy, and then haul up for it.

FROM SEA TO TYBEE ROADS.—From Tybee gas and whistling buoy steer 297° true (**NW** by **W** ⅝ **W** mag.) for nearly 3 miles with *Tybee range lights* (white skeleton structure in range with Tybee lighthouse) in line ahead until up with North Breaker red bell buoy, No. 2 T. Leave the buoy 100 yards on the starboard hand and steer 321° true (**NW** ½ **N** mag.) for 2¾ miles with *Bloody Point range lights* (white structures) in line ahead until up with bell buoy No. 13. To anchor in Tybee Roads, anchor just eastward of the dredged channel, with Tybee lighthouse bearing about 270° true (*W* mag.).

To enter by the North Slue Channel, for vessels of 11 feet draft, in the daytime with a smooth sea.—From Martins Industry light vessel make good a 254° true (**WSW** ⅝ **W** mag.) course for 16½ miles to a perpendicularly striped can buoy, from which Tybee lighthouse bears 262° true (**W** ¾ **S** mag.) distant 3½ miles. On this course care must be taken to pass at least ½ mile southward of the black can buoy off the southeasterly end of Gaskin Banks, and Tybee lighthouse should be made and kept on the starboard bow. From the perpendicularly striped can buoy steer for Tybee lighthouse, pass about 250 yards southward of nun buoy No. 2, and then head up for bell buoy No. 13.

FROM TYBEE ROADS TO QUARANTINE.—Leave bell buoy No. 13 about 100 yards on the port hand and steer 284° true (**WNW** ¾ **W** mag.) for 1¼ miles with *Jones Island range lights* (white structures) in line ahead. Pass about 100 yards northward of can buoy No. 3

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and steer 274° true (**W** ⅜ **N** mag.) for ¾ mile with *Oyster Beds range lights* (white structure in range with white brick tower) in line ahead. Leave can buoy No. 5, 75 yards on the port hand and steer 264° true (**W** ½ **S** mag.) for 1¾ miles with *Tybee Knoll Cut range lights* (white house in range with high skeleton) in line ahead. When nun buoy No. 6 is abeam, steer 281° true (**W** by **N** mag.) for about ½ mile, with *New Channel range lights* (skeleton structures) in line ahead, and the Quarantine station will be abeam.

From Quarantine to The Bight.—From abreast the quarantine station continue the 281° true (**W** by **N** mag.) for 1 mile with New Channel range lights in line ahead. When Long Island Crossing range front light is abaft the beam, turn with an easy port helm and steer 319° true (**NW** ⅜ **N** mag.) for 2¼ miles with *Long Island Crossing range lights* (pyramidal structures, north half red, south half white) in line astern until up with the old mooring wharf at Venus Point. Then follow the north bank of the river, keeping about 250 feet from the piling along the bank.

Then steer 280° true (**W** ⅞ **N** mag.) with *Lower Flats range lights* (pyramidal structures, north half red, south half white) in line astern until approaching *Elba Island light* (black post alongside of boathouse). Then follow the south bank, keeping about 200 feet from the ends of the piling, until abreast Upper Flats front light. Then turn with an easy port helm and steer 329° true (**NNW** ¾ **W** mag.) with *Upper Flats range lights* (pyramidal structures, northeast half red, southwest half white) in line astern until up with the old mooring wharf in The Bight. Then follow the north bank at a distance of about 100 yards.

From The Bight to Savannah.—Follow the north bank in The Bight and the piling eastward of Proctor Place light at a distance of about 100 yards and pass about 125 yards off *Proctor Place light* (red structure at northeast end of training wall). Then steer about 236° true (**SW** by **W** mag.) for a little over ¼ mile until the lights of *Fort Jackson range* (slatted tripods) are in line, and then stand on the range ahead, course 211° true (**SSW** ¾ **W** mag.).

When abreast the training wall at Mackey Point, steer 244° true (**SW** by **W** ¾ **W** mag.) with *Oglethorpe range front light* (square, white, low structure) in line with *Barnwell Place light* (brown, slatted, high tripod) astern, giving the south bank of the river a berth of a little over 125 yards and passing 75 to 100 yards northward of Fort Jackson (Oglethorpe).

Follow the south bank above Fort Oglethorpe at a distance of 100 yards, leave buoy No. 16 about 200 feet on the starboard hand, and steer 277° true (**W** ⅝ **N** mag.) with two slatted beacons in range astern until approaching the wharves on the south bank. Then follow the wharves on the south bank at a distance of 250 to 300 feet.

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WASSAW SOUND.[1]

The entrance to this sound lies 8 miles southwestward of Tybee lighthouse. Shoals extend offshore a distance of 3½ to 4 miles from the entrance, forming a shifting bar, through which there is a buoyed channel with a depth of about 11 feet. After crossing the bar there is a good channel with 3 to 7 fathoms, which leads along the southern and western part of the sound and for a distance of 6 miles up Wilmington River. The sound is for the most part shallow, but the channels into its principal tributaries will permit any draft that can be taken over the bar. Fishing boats are practically the only vessels using the sound.

Tybee River empties into the sound from northward; it is about 7 miles in length to its junction with **St. Augustine** and Turner Creeks; by the former it is connected with Savannah River about 5 miles below the city of Savannah; a depth of 9 feet can be taken through to Savannah River. The entrance to Tybee River is obstructed by a shoal in Wassaw Sound, over which a depth of 8 feet can be taken into the river. About 2 miles above the mouth of Tybee River it is entered from northeastward by **Lazaretto Creek**; this creek connects the river with Savannah River near its mouth and forms an inland passage with a depth of about 7 feet. **Turner Creek** connects Tybee River with Wilmington River and has a depth of 7 feet.

Wilmington River empties into Wassaw Sound from northwestward; it has a northwesterly direction for 8 miles to the village of **Thunderbolt**, and then turns northward for about 4 miles and, joining St. Augustine Creek, connects with Savannah River. The river is important only as being a part of the inland passage from Savannah to Fernandina. A depth of 9 feet can be taken through to Savannah River.

Skidaway River empties into Wilmington River from southwestward about 2 miles southeastward of Thunderbolt and 5¼ miles above Wassaw Sound, and with **Skidaway Narrows** and **Burnside River** is a part of the principal inland passage between Savannah and Fernandina; the least depth in this passage is 6 feet. **Isle of Hope** is a village on the west bank of Skidaway River about 3¼ miles above its mouth.

Romerly Marsh Creek enters the western end of Wassaw Sound at the mouth of Wilmington River, and with **Romerly Marshes** and Adams Creek forms an inland passage to Vernon River; this passage is only good for shallow-draft boats and is practically abandoned. There is another passage, used to some extent, through **Old Romerly Marsh Channel**, **Parsons Cut**, **Wassaw Creek**, Odingsell River, and Adams Creek to Vernon River; this passage has shoaled to less than 3 feet and is practically abandoned as a through route.

Savannah pilots will take vessels into Wassaw Sound.

The mean rise and fall of tides is 6.8 feet.

Currents.—The tidal currents in Wassaw Sound have considerable velocity and must be allowed for. Advantage may be taken of them on the flood to beat in or on the ebb to beat out; but no vessel, however smart working, should attempt to beat against them.

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[1] Shown on charts 155, 156, scale $\frac{1}{80,000}$; 440, scale $\frac{1}{40,000}$; price of each, $0.50.

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DIRECTIONS, WASSAW SOUND.

There are no prominent landmarks that can be readily recognized by a stranger when approaching the entrance. Wassaw Island, which forms the southern side of the entrance, is heavily wooded along its seaward side and presents a level, unbroken appearance, while Tybee Island, on the northern side of the sound, shows lower with scattered wooded hammocks. Tybee lighthouse, 8 miles northward of Wassaw Sound, shows well from off the bar and is a good mark. Approaching the entrance vessels should keep over 5 miles from shore in a depth of over 6 fathoms until the sea buoy is sighted. With the aid of the chart, vessels of 9 feet or less draft, with a rising tide and a smooth sea, should have no difficulty in entering during daylight by following the buoys. The buoyed channel was sounded in 1912, and showed no marked changes in position or depth from the last survey as charted.

OSSABAW SOUND[1]

is a broad opening in the coast 15 miles southwestward of Tybee lighthouse. The greater part of the sound is shallow, but the channels to the two river entrances have a depth sufficient for any vessel that can cross the bar. Shifting shoals extend seaward off the entrance for a distance of 3½ to 5 miles, through which two channels, the northern with a depth of about 7 feet and the southern with a depth of about 9 feet, lead into the sound. There are no aids and the entrance is not used; strangers should not attempt it without a pilot.

Vernon River enters Ossabaw Sound from northwestward. Burnside River enters Vernon River from northward about 3½ miles above its entrance, and with Skidaway Narrows and River is a part of the principal inland passage. **Montgomery** is a post village on Vernon River, 1½ miles above Burnside River; it is connected by electric road with Savannah. **Little Ogeechee River** enters Vernon River from westward about 2 miles above its mouth.

Adams Creek enters Ossabaw Sound from northward about 2¾ miles above its entrance, and with Odingsell River, Wassaw Creek, Parsons Cut, and Old Romerly Marsh Channel forms an inland route to Wassaw Sound with a depth of less than 3 feet. **Odingsell River** enters Ossabaw Sound from northward at the entrance to the sound.

Ogeechee River enters the western part of the sound, and is the second largest river on the coast of Georgia; it is navigable for a distance of about 15 miles above Florida Passage, to the railroad bridge, for small vessels of 8 feet draft. The principal inland passage leads up this river a distance of 2¾ miles, and thence through Florida Passage and Bear River to St. Catherines Sound; it has a least depth of about 6 feet.

There are no regular **pilots** for Ossabaw Sound or its tributaries. Persons competent to pilot vessels can be found at Savannah or Thunderbolt.

The mean rise and fall of **tides** is 6.6 feet.

The **tidal currents** in the sound have considerable velocity, and allowance must be made for them. The ebb setting out of Ogeechee River is particularly strong.

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[1] Shown on charts **155, 156,** scale $\frac{1}{80,000}$, price of each $0.50; **441,** scale $\frac{1}{30,000}$, price $0.25.

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ST. CATHERINES SOUND [1]

is about 24 miles southwestward of Tybee lighthouse and 21 miles northeastward of Sapelo lighthouse. The entrance to the sound is over a shifting bar which extends 5 miles offshore and in 1912 had a least depth of about 11 feet in the channel as marked by the buoys. The sound is for the most part shallow, but channels with depths of 3 to 5 fathoms lead from inside the bar into the entrances of its tributaries.

Bear River enters St. Catherines Sound from northwestward just inside the entrance; about 8 miles above its mouth the river joins **Florida Passage** and this affords an inside passage, with a depth of about 6 feet to Ossabaw Sound. A depth of 10 feet can be taken up Bear River and about 3 miles up **Kilkenny Creek**, its principal tributary. A depth between 1 and 2 feet at low water can be taken from Kilkenny Creek through **Skippers Narrows** to Florida Passage.

Medway River enters the sound from westward; with the aid of the chart the channel is not difficult to the entrance of **Belfast River**, but 6 feet at low water is about the best depth that can be taken to **Belfast** in the absence of local knowledge. A depth of about 14 feet can be taken 6½ miles above the mouth of the river to the entrance of Belfast River, and 12 feet up Belfast River for 3 miles to the mill at Belfast. Vessels load lumber to a draft of 17 feet at Belfast and are towed up and down the river. Belfast is a post office and has telephone and railroad communication; water, gasoline, and provisions can be obtained.

Walburg Creek enters the sound from southward just inside its entrance, and with North Newport River, Johnson Creek, and South Newport River form the principal inland passage to Sapelo Sound; a least depth of 7 feet can be taken through this passage.

North Newport River enters the sound from southward just west of Walburg Creek; it is of little commercial importance, except that a small part of it is used as one of the connecting links in the inland passage. Vessels formerly loaded to a draft of 16 feet at **Carrs Neck**, about 12 miles above the mouth of the river, and a draft of 6 feet can be taken nearly up to the railroad bridge (closed).

There are no towns on the sound, and Belfast is the only shipping point on its tributaries. Strangers seldom enter the sound except to load at Belfast; there are no regular local pilots, but Savannah pilots will take vessels in over the bar. On a clear day the entrance may be recognized, showing the break between the wooded points on its northern and southern sides.

The mean rise and fall of tides is 7.4 feet. The tidal currents have considerable velocity at the entrance and in the sounds.

DIRECTIONS, ST. CATHERINES SOUND.

Approaching the entrance vessels should keep over 6 miles from shore in a depth of over 6 fathoms until the Sea buoy is sighted. The surveys made of the bar in 1867 and 1904 showed that during that time the shoal on the south side of the channel for a distance of 3 miles inside the bar had extended northward, and thence to the

[1] Shown on charts 156, scale $\frac{1}{80,000}$, price $0.50; 443, scale $\frac{1}{40,000}$, price $0.25.

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south point of Ossabaw Island the shoal on the north side of the channel had extended southward; the south point of Ossabaw Island had extended southward nearly ¼ mile. With the aid of the chart vessels of about 9 feet or less draft, on a rising tide with a smooth sea, should have no difficulty in crossing the bar by following the buoys.

After crossing the bar the channel to Medway River leads northward of the horizontally striped buoy in the middle of the entrance, then 261° true (**W ¾ S** mag.) for nun buoy No. 2 on the south side of Medway Spit, and then westward along the south bank to the crossing, 1 mile above the entrance of the river. This crossing is marked by can buoy No. 1, and by small range beacons, maintained by local pilots on both the south and north banks, course 335° true (**NNW ¼ W** mag.).

The crossing 2¼ miles above buoy No. 1 is marked by small range beacons, maintained by local pilots on the north bank, which are in range astern on a 255° true (**WSW ⅝ W** mag.) course. The channel then follows the south bank to abreast Dickinson Creek, then through the East Channel past the long island at Sunbury, and follows the east bank into Belfast River until across the mouth of Tivoli River; a shoal extends halfway across from the west bank abreast Tivoli River. The channel then follows the south bank until abreast the point northwestward of a small island.

For a distance of ¼ mile northward of this point the channel follows the east bank past a mid-channel shoal with 3 feet over it, above which 6 feet at low water is about the best depth that can be carried in the absence of local knowledge; a channel 125 feet wide and 12 feet deep has been dredged here. When about ½ mile above the point the channel crosses to the west bank, which it follows until approaching the sharp bend below Belfast. Round this bend in mid-channel, and pass northward of a ballast pile, bare at low water, which lies near mid river abreast the lower end of Belfast, and is marked by piles. The tidal currents have an estimated velocity of 3 knots or more in the river at Belfast.

SAPELO SOUND [1]

is 10 miles northeastward of Sapelo lighthouse and 34 miles southwestward of Tybee lighthouse. The entrance is obstructed by shifting shoals, which extend nearly 5 miles seaward, through which there is a channel with a least depth of about 17 feet in 1912. The sound affords excellent anchorage for any vessel that can cross the bar. Vessels of too deep draft for Doboy Sound enter Sapelo Sound to Front River to load lumber, which is brought to them in rafts. The deepest draft that can cross the bar is about 22 feet at high water with a smooth sea. There are no towns or villages of any importance on the sound or its tributaries.

[1] Shown on charts 156, scale $\frac{1}{80,000}$, price $0.50; 444, scale $\frac{1}{30,000}$, price $0.25.

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South Newport River enters the sound from northward just inside the entrance; the river has a channel depth of 11 feet for a distance of 11 miles to its junction with North Newport River, and at high water 8 feet can be taken about 5 miles farther to **Retreat** post office. Entering the sound from northwestward is **Barbours Island River**, through which a draft of 8 feet at high water can be taken to South Newport River; in its northern part the channel leads southward and eastward around the large island to South Newport River.

Sapelo River, which enters the sound from westward, is navigable for vessels of about 8 feet draft at high water a distance of about 10 miles to the closed county bridge at **Eulonia**, a post office on the railroad. A channel 150 feet wide and 17 feet deep is dredged from deeper water in Sapelo River into the mouth of **Front River**. On the western side just inside the entrance of Front River is a wharf at which vessels load lumber; this is the principal shipping point for Darien.

Improvements are authorized to dredge a cut from near the head of Front River to Old Teakettle Creek, and this will form the inland passage to Doboy Sound. When these improvements are completed the inland route by way of Mud River and New Teakettle Creek will be abandoned.

Mud River enters the head of Sapelo Sound from southward; it is a broad, shallow body of water with a channel depth of 7 feet marked by range beacons, and is important only as a part of the inland passage between Savannah and Fernandina. When the passage by way of Front River is completed this route will be abandoned.

Pilots for Sapelo Sound can be obtained by writing or wiring to Darien. Pilotage is not compulsory unless the vessel is spoken by a pilot. (For pilot rates see Appendix I.)

Anchorages.—There is good anchorage anywhere in the channel of the sound, but vessels entering for shelter usually anchor in South Newport River or on either side of Dog Hammock Spit. The quarantine anchorage is off the National Quarantine Station, which is on the south side of the sound at the north end of Blackbeard Island.

The mean rise and fall of tides is 7.3 feet.

DIRECTIONS, SAPELO SOUND.

Shoals extend about 5 miles from shore, and vessels should keep in a depth of over 5 fathoms until the Sea buoy is sighted. The break in the shore at the entrance to the sound can be seen a distance of about 8 miles on a clear day, and the quarantine station can be seen from the Sea buoy. Sapelo lighthouse, 10 miles southward of Sapelo Sound, can also be seen from off the bar, and is a good mark.

With the aid of the chart vessels of 15 feet or less draft, on a rising tide with a smooth sea, should have no difficulty in entering during daylight by following the buoys. A comparison of the surveys made in 1859 and 1902 shows practically no change in the bar during that time, except in the vicinity of the shoalest part of Experiment Shoal, which has moved southward about ¼ mile; the slue between that shoal and St. Catherines Island has also deepened and extended. The buoyed channel was sounded out in 1912, and was found to be practically the same as the last survey as charted.

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When in the sound pass about ¼ mile northward of the quarantine station and stand westward in the buoyed channel to an anchorage northward of Dog Hammock Spit. The channel into Front River should be taken by a stranger on a rising tide.

DOBOY SOUND AND DARIEN [1]

is 46 miles southwestward of Tybee Roads and 16 miles northeastward of St. Simon lighthouse; it is marked on its northern side by Sapelo lighthouse and a disused lighthouse, and on its southern side by a disused lighthouse (two-story building). The entrance is about 1 mile wide, and is obstructed by shifting shoals, which extend about 4½ miles offshore. In 1912 there was a depth of between 8 and 9 feet in the channel over the bar, this depth being found on lumps with slightly deeper water between. The deepest draft crossing the bar in 1912 was 15 feet at high water. The sound extends northwestward for a distance of about 5 miles and has an average width of ¾ mile; it is the commercial outlet of numerous tributaries, and also of the Altamaha River; lumber is the principal commodity.

Sapelo lighthouse is a white, square, pyramidal skeleton tower, upper part black. The light shows 6 flashes every 30 seconds (flashes 0.6 second, 5 eclipses of 1.9 seconds, and 1 eclipse of 16.9 seconds), 100 feet above the water, and visible 16 miles. Nearly 300 yards southwestward of it is a disused light tower, with red and white bands.

Duplin River enters Doboy Sound from northward about 1½ miles inside of Sapelo lighthouse; it is a small stream about 5 miles long and good for a depth of 9 feet until near its head. **Inverness** is a post office about 3½ miles above the mouth of the river.

New Teakettle Creek enters the sound from northward about 1 mile northwestward of Duplin River. This creek connects with Mud River and forms part of the inland passage; a depth of 7 feet can be taken through this passage.

Old Teakettle Creek branches from New Teakettle Creek and joins Mud River farther westward. See the description of Front River under Sapelo Sound, preceding.

Atwood River and **Hudson Creek** are small streams emptying into the head of the sound from northwestward. About 7 feet can be taken up the former for a distance of 2½ miles, and 9 feet about 3 miles up the latter.

Connegan River enters the head of the sound from southwestward; it joins North River by a branch known as **Buzzards Roost Creek**, through which 8 feet may be taken.

North River enters Doboy Sound west of Doboy Island. It extends westward 6 miles to the post village of **Ridgeville**, to which a draft of 14 feet can be taken. Here it joins **May Hall Creek**, which, running southward, connects with Darien River 5 miles above its mouth. There is a depth of about 13 feet in May Hall Creek, except where it enters Darien River the depth is only 4 feet; a draft of 8 feet can be taken through at high water.

Back River is on the southern side of Doboy and Commodore Islands and forms another entrance from the sound to North and Darien Rivers; it is little used.

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[1] Shown in parts on charts **156, 157,** scale $\frac{1}{80,000}$; price of each, $0.50; **446,** scale $\frac{1}{40,000}$; price, $0.25.

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Darien River extends southwestward for a distance of 11½ miles, where it joins the Altamaha River. The town of **Darien** is 8½ miles above Doboy Island on the north bank of the river. Darien has daily steamboat communication with Brunswick; it also has railroad and telephone communication. A least depth of 11 feet can be taken to Darien, and vessels load to 15 feet at the sawmills and are towed to sea over Doboy bar. Large rafts of timber are sometimes secured to the banks of the river at and below Darien, and sunken logs are sometimes bad near the town. The water is fresh in the river after the ebb has been running about 3 hours. There is a depth of about 3 feet at ordinary low tides into Altamaha River; only light-draft steamers are engaged in the carrying trade on the river.

Light-draft vessels running between Darien and Brunswick use the route through **Three Mile Cut**, which has a least depth between 2 and 3 feet at its south end. In the absence of local knowledge, this passage is recommended only for launches of less than 5-feet draft. The route follows the channel of Darien River to the point on the north bank northeastward of Three Mile Cut, then crosses to the south bank eastward of the mouth of a small slue, and then follows the south bank into Three Mile Cut. At the south entrance of Three Mile Cut the channel leads eastward of an islet, passing close to the marsh on the east bank, then eastward for about 300 yards along the north bank of Altamaha River, then southward and westward around a middle ground until Three Mile Cut bears eastward of north, and then southward to the south bank. It then leads eastward along the south bank through **One Mile Cut** to Buttermilk Sound, where it joins the regular inside route.

A branch of Darien River known as **Rockdedundy River** connects with Little Mud River from Altamaha Sound, and forms part of an inland passage with a depth of about 6 feet.

South River enters Doboy Sound from southwestward about ¾ mile inside the entrance. It extends in a general westerly direction for 3 miles, where it joins Little Mud River; it is little used.

Pilots for Doboy Bar can be had by writing or wiring to Darien, and if pilots are desired for the inland passage they can generally be obtained at either Darien or Brunswick. Pilots for Doboy Sound will also take vessels into St. Catherines or Sapelo Sounds. Bar pilotage is compulsory for certain vessels. For pilot rates, see Appendix I.

Towboats belonging to the sawmills on the waters tributary to the sound cruise outside if a vessel is expected to arrive, and they will come out to a vessel signaling for one. All sailing vessels bound to Darien take a towboat, and when loaded tow out over the bar. Towboats can be had at Darien.

Hospital.—At Darien there is a relief station of the United States Public Health Service.

Anchorages.—There is good anchorage anywhere in the channel of the sound inside the entrance, but vessels usually stand up until abreast the mouth of North River, near the red buoy at its entrance. Vessels subject to visitation by the health officer must wait to be boarded in the sound. There is good anchorage in about 21 feet in North River, but the channel is too narrow for a large vessel to anchor in Darien River.

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Supplies.—Provisions and gasoline can be had at Darien. Vessels can obtain fresh water from water boats. The nearest places for obtaining coal for steamers are Brunswick and Savannah.

Repairs to hulls of vessels and machinery of steamers can not be made nearer than Savannah. (See also Brunswick Harbor.)

Wharves.—The depth of water alongside the wharves at Darien is 7 to 14 feet, and all vessels make fast to wharves or piling, as the river is too narrow for them to anchor near the town.

The mean rise and fall of tides is 7.3 feet at Sapelo lighthouse and 6.5 feet at Darien. The tidal currents on the bar have a velocity of about 1½ knots on the ebb and slightly less on the flood.

DIRECTIONS, DOBOY SOUND.

Shoals extend nearly 5 miles from shore in places in the vicinity of Doboy Sound, and vessels should keep in a depth of 5 fathoms or more until the Sea buoy is sighted. If there is too much sea to cross Doboy bar, vessels can make an anchorage in Sapelo Sound.

The surveys of Doboy bar in recent years show it to have been in a state of change. The successive surveys have shown a steady shoaling of the present buoyed channel; the indications are that this shoaling will continue and close this channel in a few years and that a deeper channel is forming between what is now called North Breakers and Chimney Spit. By the survey of 1912 the buoyed channel, which leads in a northwesterly direction, crosses two bars, the outer one with depths of 10 to 12 feet and the inner one with 8 to 9 feet. It is not considered safe for a stranger to attempt to enter by following the buoys with a greater draft than 7 feet, and then only under the safest condition of a rising tide and a smooth sea.

When across the bar, the chart is a good guide in the sound to an anchorage near buoy No. 8 at the entrance of North River. Sailing vessels require a towboat from this anchorage to Darien, but small, powered vessels up to about 9 feet draft should have no difficulty in going up to the town. Chart 446 is the best guide.

Leaving buoy No. 8 on the starboard hand, the channel follows the west bank of North River until abreast the north end of Doboy Island. Then favor the shore of Doboy Island and pass 75 to 100 yards off the south end of this island. Doboy Island is wooded, and there are several ruined buildings on its southwest end. Then cross Back River on a 181° true (S mag.) course and favor the east bank to the mouth of Darien River. Then follow the ebb-tide bends up Darien River, favor well the east bank in crossing the mouth of Rockdedundy River, and continue to follow the ebb-tide bends to Darien, passing through Pico Cut. The principal mill near Darien is at the north end of the long bend, the entrance of which is at the east end of Pico Cut. Wing dams to confine the channel are built out from the banks in places, and are marked by piles which show above water.

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ALTAMAHA SOUND[1]

is 5 miles southward of Sapelo lighthouse and about 11 miles northeastward of St. Simon lighthouse. The entrance is so much obstructed by shoals and the sound itself is so full of them that it is rarely entered by anyone, and never by strangers. There is a channel through the shoals, which extend out for a distance of 4 miles from the entrance, but this channel shifts and is not marked. The vessels entering the sound pass in through Doboy or St. Simon Sounds and then through the inland passage.

Altamaha River is formed by the confluence of the Oconee and Ocmulgee Rivers, 112 miles above the town of Darien and 122 miles above its mouth, and flows in a general southeasterly direction, entering the western end of Altamaha Sound. This river is shallow and crooked, and has a least depth of about 2½ feet for its entire length. Considerable timber is rafted down these rivers for shipment from Darien and Brunswick. The influence of the tides is felt in the river for a distance of about 20 miles above Darien. **Oconee River** has a channel depth of about 2½ feet to the city of **Milledgeville**, about 126 miles above its junction with Altamaha River. **Ocmulgee River** has a channel depth of about 2½ feet for a distance of 178 miles to the city of Macon. The principal cities, towns, and villages on the river, with their distances above the junction with the Altamaha River, are: **Lumber City**, 10 miles; **Abbeville**, 62 miles; **Hawkinsville**, 114 miles; and **Macon**, 178 miles.

Little Mud River enters Altamaha Sound from northward about 2½ miles inside the entrance. It is important only as being part of the inland passage from Doboy Sound to Altamaha Sound.

Buttermilk Sound enters Altamaha Sound from southwestward. It has an average width of ½ mile, but is full of shoals, through which there is a narrow channel. At its head the sound connects with Frederica River and Mackay River, the latter connecting with Back River. These three rivers enter the western end of St. Simon Sound from northward, and Frederica River with Buttermilk Sound forms part of the regular inland passage, through which a depth of 7 feet may be taken at low water.

The mean rise and fall of **tides** in the entrance to Altamaha River is 6.4 feet.

ST. SIMON SOUND AND BRUNSWICK HARBOR[2]

lie 17 miles southward of Sapelo lighthouse and 9 miles northward of Little Cumberland Island lighthouse. On the northern side of its entrance, which is ⅞ mile wide, is St. Simon lighthouse. This sound is one of the most important harbors on the coast of Georgia, being the approach to the city of Brunswick, which is the second seaport in commercial importance in the State.

The entrance is obstructed by dangerous shifting shoals, which make offshore to a distance of 5½ miles, forming a bar through which there is a dredged channel 400 feet wide and 23 feet deep, marked by range lights; this depth is maintained by dredging, although the channel may not always have its full width. The deepest

[1] Shown on charts 157, scale $\frac{1}{80,000}$, price $0.50; 446, scale $\frac{1}{40,000}$, price $0.25.

[2] Shown on charts 157, scale $\frac{1}{80,000}$, price $0.50; 447, scale $\frac{1}{40,000}$, price $0.25.

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draft taken over the bar in 1912 was 25½ feet. Inside the bar and in the channel of the sound there is a good depth of water and excellent anchorage.

Brunswick light vessel is moored in a depth of 50 feet, 14¼ miles 123° true (SE by E ⅛ E mag.) of St. Simon lighthouse, and 13 miles 82° true (E ¾ N mag.) of Little Cumberland Island lighthouse. The vessel has a yellow hull, with "Brunswick" on each side, and two masts with lanterns and red elliptical daymarks at head of each. The lights are fixed white, 50 feet above the water, and visible 13 miles. The fog signal is a steam whistle, blast 5 seconds, silent intervals 55 seconds. If the whistle is disabled the ship's bell will be struck by hand 8 strokes, silent interval 4 seconds, 4 strokes, silent interval 40 seconds. The submarine bell strikes "84," thus: 8 strokes in 22⅔ seconds, silent interval 4 seconds, 4 strokes in 11⅓ seconds, silent interval 8 seconds.

St. Simon lighthouse is a white conical tower attached to a brick dwelling. The light is fixed white varied by a white flash (fixed 30.0 seconds, eclipse 12.5 seconds, flash 5.0 seconds, eclipse 12.5 seconds), 104 feet above the water, and visible 16 miles.

Entering the western end of the sound from northward are **Frederica, Mackay,** and **Back Rivers.** These all extend northward and connect with Buttermilk Sound, and thus afford a passage into Altamaha Sound. Frederica River is the easternmost of the three rivers and the one used by vessels passing through the inland passage.

St. Simon Mills is a village on the east bank of Frederica River, about 1½ miles above its mouth. There are several abandoned mills here. There is 12 feet of water in the channel up to the village, and vessels formerly loaded to a draft of 18 feet at the mills.

Brunswick River enters the sound from southward and just inside the entrance. The river for a distance of 2¾ miles above its mouth has an average width of 1¼ miles, but the deep-water channel averages only a little over ¼ mile in width, and in one place is only 200 yards wide. Above Brunswick Point the river for a distance of about 2½ miles has an average width of ¾ mile, and above this it is divided into two branches by Buzzards Island. The southern branch is known as **Turtle River,** and the northern branch, on which the city of Brunswick is situated, is known as the **East River,** or Brunswick Harbor. The city of **Brunswick** is about 7¼ miles above St. Simon lighthouse; it has regular steamboat communication with Darien, Fernandina, and intermediate places, and a large coastwise and foreign commerce. A depth of 23 feet at low water can be taken up East River to Brunswick, and up Turtle River to the Southern Railroad wharves.

South Brunswick River enters Brunswick River from westward opposite Buzzards Island. **Fancy Bluff Creek** enters South Brunswick River from southwestward 1¼ miles above its mouth; this creek affords a crooked, narrow channel, good for a depth of about 7 feet at high water, to Little Satilla River.

Jekyl Creek enters Brunswick River from southward about 2½ miles above its mouth; with Jekyl and St. Andrews Sounds it forms part of the inland passage to Fernandina. A depth of 7 feet at low water can be taken from Brunswick River through the creek. The dredged entrance from Brunswick River is marked by range lights (white structures).

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Plantation Creek and **Clubb Creek** have been improved to a depth of 7 feet. The entrance from Brunswick River is on a range of two beacons, and the channel then leads through a cut across the marsh in a northeast direction, cutting off the westerly loop of Plantation Creek. The channel is in the middle of Plantation Creek, except in the reach trending southward of east where it favors well the north bank; then after favoring the outside of the sharp bend, the channel favors the east bank until halfway up the northward trending reach. The channel then leads through a cut to Clubb Creek, and so in midcreek to Back River.

Back River, with Mackay River, is used by stern-wheel steamers as a part of an inland route to Altamaha River. There is a depth of 4 feet at low water through Back River to Mackay River. On Back River 2¼ miles above Clubb Creek there is a mill at which vessels load to a draft of about 17 feet.

Prominent features.—In clear weather St. Simon lighthouse shows well at a distance of 8 miles, and from the gas and whistling buoy Little Cumberland Island lighthouse can be seen southwestward. Near the beach eastward and northeastward of St. Simon lighthouse are a number of cottages and several large houses.

Pilots.—Pilot boats usually cruise off the entrance and one boat is always stationed off the bar, except in very heavy weather, when she is anchored inside. Pilotage is compulsory for certain vessels. For pilot rates see Appendix I. Pilots for the inland passage can be obtained at Brunswick.

Towboats are usually employed by the larger and deeper draft sailing vessels; they can be had at Brunswick and by making signal outside.

Quarantine.—The national quarantine station is at Brunswick Point, on the north bank of Brunswick River, about 1½ miles below the city. Vessels subject to visitation by the health officer will be boarded in the sound.

Hospital.—At Brunswick there is a relief station of the United States Public Health Service.

Harbor control.—The limit of speed of steamers passing the wharves of Brunswick is 4 miles an hour, and the engine must be stopped and turned over slowly when passing where two or more vessels are moored abreast and where barges or flats are employed at any point in the harbor.

Anchorages.—There is good anchorage anywhere in the channel in St. Simon Sound or Brunswick River. Off the city of Brunswick there is no anchorage, except for small craft westward of the Brunswick Harbor range; small vessels can anchor in East River near the mouth of Academy Creek.

Supplies.—Provisions, ship chandler's stores, anthracite or bituminous coal, gasoline, ice, and fresh water can be obtained at Brunswick.

Repairs.—Light repairs can be made to the machinery of steamers, and there is a small marine railway with a capacity of about 400 tons and a draft of 7 feet forward and 12 feet aft; but Savannah and Jacksonville are the nearest places where large vessels can be hauled out for extensive repairs.

Wharves.—The facilities for loading and discharging cargoes at Brunswick are good; there is from 7 to 28 feet alongside the wharves according to locality, and 26 feet at the wharves of the Southern Railroad on Turtle River.

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Storm warnings are displayed at Brunswick.

The mean rise and fall of the **tides** on the bar is 6.3 feet.

The **tidal currents** follow the general direction of the dredged channel across the bar, and have an estimated velocity of 1 to 2 knots; they set diagonally across the Plantation Creek range. Currents turn about 1 hour after high and low water.

DIRECTIONS, ST. SIMON SOUND AND BRUNSWICK HARBOR.

A depth of 23 feet is maintained by dredging from sea to Brunswick and the Southern Railroad wharves on Turtle River. The following directions lead in the improved channels; it is proposed to establish new sets of range lights to mark them, as mentioned in the directions. Some local knowledge is required to follow the dredged channels, or to insure a greater depth than about 18 feet at low water under favorable conditions. This depth, and less in places, will be found on both sides of the buoyed channel over the bar. The tidal currents set with the channel on the bar, but with northerly or southerly winds a current, which should be kept in mind, sets with the wind across the channel.

Approaching St. Simon Sound from any direction shape the course for Brunswick light vessel, from which a 303° true (**NW** by **W** ⅛ **W** mag.) course for 7 miles will lead to St. Simon gas and whistling buoy. When the light vessel is sighted a course can be shaped to pass as much as 5 miles inside of it; then bring it astern on a 303° true (**NW** by **W** ⅛ **W** mag.) course until up with St. Simon gas and whistling buoy. Soundings of 4½ to 5½ fathoms have been found on what appears to be a bank or broken ground, lying 2 to 4½ miles east-southeastward of St. Simon gas and whistling buoy. This area should be avoided in heavy weather. There is also a spot with 4½ fathoms over it lying about ⅜ mile north-northeastward of St. Simon gas and whistling buoy.

From St. Simon gas and whistling buoy steer 303° true (**NW** by **W** ⅛ **W** mag.) heading for *St. Simon lighthouse* (white conical tower); on this course *St. Simon range front light* (white skeleton structure) will be in line with St. Simon lighthouse. Continue the course, keeping close on the range which leads about midway between the buoys marking the sides of the channel.

When abreast nun buoy No. 14 steer 285° true (**WNW** ¾ **W** mag.) with *Plantation Creek range lights* (white structures) in line ahead, and pass about 200 yards northward of can buoy No. 13. Good anchorage can be found northward of the range and about ½ mile northwestward of buoy No. 13.

ST. SIMON SOUND TO BRUNSWICK.—When about ½ mile westward of can buoy No. 13 steer 218° true (**SW** ⅝ **S** mag.) for 1¾ miles, passing about 200 yards southeastward of nun buoy No. 16 and

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giving the shore of Jekyl Island a berth of at least 200 yards. On this course the *Jekyl Island range lights* (white structures) will be a little on the starboard bow; it is proposed to move these lights to mark this course.

Then steer 256° true (**WSW ¾ W** mag.) passing about 200 feet southward of nun buoys Nos. 18 and 20. It is proposed to establish range lights in the vicinity of Cedar Hammock to mark this course.

When about 300 yards past nun buoy No. 20 steer 293° true (**WNW** mag.) heading for can buoy No. 1 and give the north bank a berth of about 350 yards. The *Colonels Island range lights* (white structures) will be a little on the port bow; it is proposed to move these lights to mark this course. When the Quarantine station is abeam, steer 299° true (**NW by W ½ W** mag.) for 1 mile heading for a red and black horizontally striped nun buoy. Then steer 344° true (**N by W ½ W** mag.) with *Brunswick Harbor range lights* (white structures showing just eastward of a lone shack) in line ahead. Stand in on this range giving the wharves along the city front a berth of 75 to 100 yards, and make fast to a wharf until assigned a berth by the harbor master.

To the Southern Railroad wharves on Turtle River.—Some local knowledge is required to follow the dredged channels, or to insure a greater depth than about 18 feet at low water. It is proposed to establish ranges to mark the dredged cuts, and the following courses indicate the lines to be marked:

From abreast the quarantine station the course is 293° true (**WNW** mag.) on a range of two small white beacons, maintained by the United States Engineers, which show at the end of the high wooded part of Colonels Island; it is proposed to establish range lights northward of the Colonels Island range to mark this course; leave two can buoys 150 feet on the port hand. When about ½ mile westward of buoy No. 3, haul gradually northward in mid river until abreast the north point of South Brunswick River. Then steer 338° true (**NNW** mag.) following the west bank at a distance of 250 yards until abreast the south point at the entrance of East River. Then steer 10° true (**N ⅞ E** mag.) for the water tank at the Southern Railroad wharves, with two daymarks, maintained by the United States Engineers, on Blythe Island in range astern; it is proposed to establish range lights on Blythe Island to mark this course.

ST. ANDREW SOUND[1]

lies about 7 miles southward of St. Simon Sound and 17 miles northward of St. Marys entrance. On the southern point at its entrance is Little Cumberland Island lighthouse. In the sound are extensive shoals, between which channels lead into its

[1] Shown on charts **157**, scale $\frac{1}{80,000}$, price **$0.50**; **448**, scale $\frac{1}{40,000}$, price **$0.25**; **450**, Satilla River, scale $\frac{1}{20,000}$, price **$0.50**.

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principal tributaries, which are known as Jekyl Sound, Satilla River, and Cumberland River. The entrance is over a shifting bar, which extends 5 miles offshore, and is usually good for a depth of 14 feet at low water. The sound is little used as a harbor. A number of vessels enter Satilla River to load lumber, and the vessels using the inland passage cross the sound. Jekyl Creek and Jekyl Sound from northward, and Cumberland River from southward, are parts of the inland passage connected by St. Andrew Sound.

Little Cumberland Island lighthouse is a white conical tower. The light is fixed white, 71 feet above the water, and visible 14 miles.

Jekyl Sound enters St. Andrew Sound from northward just inside the northern point at the entrance. It is full of shoals, between which there are three channels which lead to its three principal tributaries. **Jekyl Creek** enters the sound from northward; it is part of the inland passage, its northern part connecting with Brunswick River; a depth of 7 feet can be taken from Jekyl Sound to Brunswick River. **Jointer Creek** enters Jekyl Sound from northwestward; it is crooked and has a number of narrow branches, which connect with Brunswick River above Jekyl Creek. About 12 feet can be taken into the creek at low water, and about 4 miles above its mouth. **Little Satilla River** enters Jekyl Sound from westward, and is good for a depth of 12 feet for several miles above its mouth. Jointer Creek and Little Satilla River are of little importance. Small craft going to the landings on Little Satilla River enter from South Brunswick River through Fancy Bluff Creek, which is good for about 7 feet at high water.

Cumberland River enters St. Andrew Sound from southward just inside the point of Little Cumberland Island; its general direction is southerly for a distance of 11 miles, where it joins Cumberland Sound, thus affording a passage good for a depth of about 7 feet at low water. The most difficult part of the passage is at the "Divide" at the north mouth of Crooked River; at this point the channel is marked by range beacons.

Satilla River enters St. Andrew Sound from westward; its entrance is obstructed by extensive shoals, between which there is a narrow channel. The settlements on the river have communication with Brunswick by telephone, and there is railroad communication from **Woodbine**, 22 miles above its mouth; a railroad bridge crosses the river at Woodbine (width of draw 52 feet). A steamer from Brunswick makes regular trips to points on the river up to **Burnt Fort**, 45 miles from the mouth, to which there is a depth of 6 feet at low water. Seagoing vessels load lumber at the mills on the river as far up as **Owens Ferry**, 28 miles above the mouth, to which point there is a depth of 11½ feet at low water or 18½ feet on a good high water. Provisions and artesian water can be obtained at the mills and other settlements; a small quantity of gasoline can be had generally at Owens Ferry.

Vessels bound to Satilla River enter at Brunswick light and tow through Jekyl Creek; when loaded they are towed to sea, with the aid of a pilot, over St. Andrew Bar. The channel follows the ebb tide bends, and with the aid of charts 448 and 450 steamers of moderate draft (say up to 10 feet) should have no difficulty in going as far as Owens Ferry. The only sharp turn below Owens Ferry is at **Hopewell Point**, where special care is also required on account of the narrow channel. There

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are no aids above the entrance. The mean rise and fall of tides is about 6.9 feet at the entrance, 6.8 feet at Ceylon, and 3.4 feet at Burnt Fort.

White Oak River empties into Satilla River from northward 15 miles above its mouth; a draft of 8 feet at high water can be taken 10 or 12 miles above its mouth to **White Oak** and **Waverly**, which are railroad stations at the head of navigation on its two branches.

Brickhill River is a branch of Cumberland River, from which it branches about 5 miles above its mouth and again joins it a short distance north of the "Divide."

Floyds Creek enters Cumberland River from westward about 4½ miles above the north end of Little Cumberland Island. For a distance of nearly 3 miles above its mouth the channel in the creek has a depth of about 19 feet. With local knowledge a draft of 6 feet at high water can be taken from the head of Floyds Creek westward through a shallow pond into **Todds Creek**, and thence northward to Satilla River.

Shellbine and **Delaroche Creeks** enter Cumberland River from westward; they are both narrow and crooked; the former is navigable for a draft of 8 feet at low water, and the latter for a draft of 7 feet, but neither creek is of importance.

Pilots will be found cruising off St. Simon Bar, and there is one on Cumberland Island at High Bluff (locally Cumberland High Point). The pilot regulations and rates for St. Andrew Sound and Satilla River are the same as for St. Simon Sound and Turtle River. Pilotage is compulsory for certain vessels.

Towboats.—There are no regular towboats in St. Andrew Sound, but vessels desiring to tow up the Satilla River can get a towboat from Brunswick.

Anchorages.—The best anchorage is in the channel, on the western side of Little Cumberland Island; here the depth ranges from 3½ to 4½ fathoms, and the holding ground is good. There is also good anchorage in the entrance to Jekyl Sound, westward of the southern end of Jekyl Island.

The mean rise and fall of tides in the sound is 6.8 feet.

DIRECTIONS, ST. ANDREW SOUND.

Sailing vessels going to the mills on Satilla River are practically the only ones trading to St. Andrew Sound, and these enter St. Simon Sound and are towed through Jekyl Creek and up Satilla River. Shoals extend about 5 miles from shore in the vicinity of St. Andrew Sound, and the depth should not be shoaled to less than 5 fathoms (low water) until the sea buoy is sighted. The entrance is marked by Little Cumberland Island lighthouse, and Brunswick light vessel is the principal aid in the northern approach. With the aid of the chart vessels of about 10 feet draft should have no difficulty in entering St. Andrew Sound, on a rising tide with a smooth sea, by following the buoys. From St. Andrew Sound the channel to Satilla River leads northward and northwestward of Horse Shoe Shoal, and then across to the south bank of the river, and is marked by beacons and buoys for this distance. See the description of Satilla River preceding.

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CUMBERLAND SOUND AND ST. MARYS ENTRANCE[1]

is 16 miles southward of Little Cumberland Island lighthouse and 19 miles northward of St. Johns River. Amelia Island lighthouse is about 2 miles southward of the entrance; a standpipe in Fernandina, and a water tank on Cumberland Island, 1¼ miles above its south end, are also prominent. The sound extends northward, and, connecting with Cumberland River, forms an inland passage to St. Andrew Sound; it is also the approach to the city of Fernandina and the town of St. Marys.

The entrance, which is about 1 mile wide, has been improved by two jetties, which extend from the shore for a distance of 3 miles on the north side and 1½ miles on the south side. The bar, just outside of and between the jetties, has a buoyed channel, which in June, 1912, had a least depth of about 24 feet. The deepest draft taken from Fernandina over the bar in 1912 was 28 feet.

Amelia Island lighthouse is a white conical tower. The light is flashing white (flash 2.5 seconds, eclipse 7.5 seconds), 107 feet above the water, and visible 16 miles.

St. Marys River empties into Cumberland Sound from westward and is its principal tributary. The settlements on the river have telephone communication, and there is railroad communication at St. Marys and Crandall. A steamer from Fernandina makes regular trips to points on the river to Kings Ferry. The principal shipping points for lumber are **St. Marys**, 4 miles above the mouth of the river; **Crandall**, 10 miles; and **Kings Ferry**, 32 miles. The least depth to these points is 13 feet, and improvements are authorized to obtain a channel 17 feet deep to Crandall. In 1912 vessels loaded to 18 or 19 feet at St. Marys and Crandall and about 16 feet at Kings Ferry. There is a depth of 8 feet to the A. C. L. Railroad bridge (closed), 48 miles above the mouth; this bridge is 22 feet above high water. The S. A. L. Railroad drawbridge (57 foot opening) crosses the river 20 miles above its mouth.

Chart 157 shows St. Marys River to a point 3 miles above St. Marys. Above this point the channel follows the ebb-tide bends, and vessels of about 10 feet draft should have no difficulty in going as far as Kings Ferry on a rising tide. The river is very crooked, and some of the turns are sharp. The mean rise and fall of tides is about 5.9 feet at the entrance, 4.1 feet at the drawbridge, 2.8 feet at Kings Ferry, and 1.4 feet at the closed bridge. **Towboats** can be had at Fernandina or St. Marys. Above the S. A. L. Railroad, the water in St. Marys River is fresh, and is used by vessels.

Amelia River enters the sound from southward just inside the entrance; the city of Fernandina is situated on the east bank about 2 miles above its mouth.

The city of **Fernandina** has railroad communication, and steamboat communication with New York, Brunswick, and St. Marys. Considerable lumber, phosphate, and some naval stores are shipped from the port in coastwise and foreign vessels. About 2⅝ miles above Fernandina is Kingsleys Creek, through which the South Amelia River is entered; the latter river extending southward to Nassau Sound forms an inland passage between the two sounds.

Bells River enters Amelia River from westward opposite the city of Fernandina; the former river joins St. Marys River about 1½ miles above the town of St. Marys and has a narrow and crooked channel. **Jolly River** branches eastward from Bells

[1] Shown on charts 157, 158, scale $\frac{1}{80,000}$, price of each $0.50; 453, scale $\frac{1}{20,000}$, price $0.25.

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River about 6 miles above the mouth of the latter and empties into Cumberland Sound at the mouth of St. Marys River.

Pilots will usually be found cruising outside the bar; their headquarters are at **Old Fernandina.** Pilotage is compulsory for certain vessels. Pilots for the inland passages can be obtained at Fernandina. The pilot regulations and rates and harbor regulations for the port of Savannah have been adopted for the port of St. Marys.

Towboats.—Sailing vessels usually employ a towboat when crossing the bar or if bound up St. Marys River; towboats are to be had at Fernandina.

Quarantine.—The quarantine boarding station for Fernandina and St. Marys River is near Fort Clinch. Vessels bound to Fernandina must not proceed above the quarantine station until they have been visited by the health officer.

Hospital.—At Fernandina there is a relief station of the United States Public Health Service.

Anchorages.—There is good anchorage in the channel of Cumberland Sound and in the Amelia River up to the city of Fernandina. Vessels are forbidden to anchor in the Amelia River, abreast of the city, between Calhoun Street and the site of the creosote works.

Supplies.—Provisions and some ship chandler's stores can be had at Fernandina. Coal, both anthracite and bituminous, can be had at the wharves in Fernandina. Fresh water can be obtained at the wharves and from water boats at Fernandina, and can be taken from the St. Marys River about 30 miles above its mouth.

Repairs.—There are no special facilities for repairs to vessels or machinery of steamers. Jacksonville and Savannah are the nearest places where vessels can be hauled out and where there are facilities for extensive repairs.

Wharves.—The facilities for loading and discharging vessels are good, the depth alongside the wharves at Fernandina is 16 to 29 feet, according to locality, and at St. Marys from 18 to 20 feet.

Storm warnings are displayed in Fernandina near the post office.

For **tides**, see table, page 30, also the tide tables for the Atlantic Coast of the United States, published annually in advance by the Coast and Geodetic Survey, in which the tides are predicted for every day of the current year.

The **tidal currents** at the entrance have great velocity and are dangerous at times, especially on the flood. Local pilots state that the conditions are about as follows: Between the bell buoy and the end of the north jetty the flood current sets southwestward, and with northeasterly winds sets strongly in a direction about south-southwest. Under the worst conditions of the flood on spring tides and a northeast gale, the velocity near the end of the north jetty is estimated to be as much as 5 knots at times. On the flood an eddy current sets out close along the inside of the north jetty. The ebb current appears to set directly out across the bar. In the present position of the channel, near the north jetty, the worst conditions for entering are on the flood with northeasterly winds, when vessels, especially long ones, are liable to strike the inside of the north jetty. Normally slack water occurs about 30 minutes after high and low water. With freshets in St. Marys River the ebb current may run from about high water until about 1½ hours after low water.

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DIRECTIONS, ST. MARYS ENTRANCE AND FERNANDINA HARBOR.

The surveys indicate a movement of the bar, including the middle ground between the jetties, seaward at the rate of 200 to 400 feet per year and an increase in the general depths on the entire bar. The most important change affecting the marked channel is an easterly extension at the rate of about 200 feet a year of the easterly part of the shoal on the south side of the north jetty near buoy No. 4; the width of this part of the shoal from the north jetty is also increasing. In June, 1912, there was a depth of about 23 feet in the buoyed channel; but local knowledge is required to carry the best water, and the tidal currents have great velocity, especially the flood with northeast winds, and vessels of greater draft than about 15 feet are advised to take a pilot.

FROM NORTHWARD.—From Brunswick light vessel a 206° true (**SSW ¼ W** mag.) course made good for 18 miles should lead to a position with Amelia Island lighthouse, or the standpipe in Fernandina, bearing 241° 30′ true (*SW by W ⅜ W* mag.). A 259° true (**W by S** mag.) course made good for 3¼ miles should then lead to the whistling buoy off the entrance. On a clear day the lighthouse and standpipe will be visible about 9 miles. In thick weather, if uncertain of the position, keep in a depth of not less than 7 fathoms.

FROM SOUTHWARD.—From St. Johns gas and whistling buoy a 356° true (**N ⅜ W** mag.) course made good for 19¾ miles should lead to a position ½ mile eastward of the whistling buoy off the entrance. On this course the nun buoy off Nassau Sound entrance will be left about 2¼ miles on the port hand. This course leads over broken ground with least depths of 4½ and 4¾ fathoms, and deep-draft vessels should keep farther eastward in a depth of over 8 fathoms until off the entrance.

From the whistling buoy steer 252° true (**WSW ⅜ W** mag.) with *Fort Clinch range lights* (black structures) in line ahead; the rear light of this range is on the south end of Fort Clinch, a red brick structure. For a distance of ⅜ mile inside the black bell buoy until about ¼ mile from the end of the jetty vessels should keep over 300 yards northward of the range line, especially with any sea running. Then stand in on the range, leaving the end of the north jetty about 100 yards on the starboard hand and leaving the buoys on the side indicated by their color.

When about ¼ mile past nun buoy No. 4 steer 260° 30′ true (**W ⅞ S** mag.) with *Tiger Island range lights* (white structures) in line ahead. When Fort Clinch range front light is abeam keep a little northward of the Tiger Island range until past Fort Clinch, and then round the northwest end of Amelia Island at a distance of about 300 yards.

Pass about 125 yards off the wharf at the Quarantine station, steer 168° true (**S by E ⅛ E** mag.) for the water tower (standpipe) in Fernandina, and then follow the wharves at a distance of about 100 yards.

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NASSAU SOUND[1]

is 10 miles southward of Amelia Island lighthouse and 6 miles northward of St. Johns River lighthouse. The entrance is obstructed by shifting shoals which extend about 1¼ miles seaward and form a shallow bar, but there are no aids and the entrance is not used. **Nassau River** is navigable for some 15 miles to the S. A. L. Railroad closed bridge; some lumber is towed inside to Jacksonville and Fernandina. **South Amelia River**, which enters the sound from northward, connects with **Kingsleys Creek**, and through the latter has communication with Amelia River and Cumberland Sound; the depth through this passage is about 4 feet. The mean rise and fall of tides is about 5.4 feet. **Sawpit Creek**, which enters the sound from westward, connects with **Gunnisons Cut** and **Sister Creek**, forming the inside passage to St. Johns River.

ST. JOHNS RIVER.[2]

This river, the largest and most important of eastern Florida, is about 244 miles in length. It rises near the Atlantic coast, in about latitude 28° 10′ N., flows in a northerly direction nearly parallel to the coast, and empties into the sea immediately north of St. Johns River lighthouse, in latitude 30° 24′ N. The river is the approach to the city of Jacksonville and a large number of towns and villages. The part of the river above Jacksonville is described under a separate heading.

The entrance of the river is between two converging jetties which extend out across the bar. The channel is under improvement to secure a depth of 30 feet from sea to Jacksonville; in 1912 there was a least depth of 23 feet in the channel, and the deepest draft taken out of the river was 24½ feet. The channel is 600 feet wide across the bar and 500 feet wide to the anchorage basin opposite Mayport. Thence to Jacksonville the channel is 300 feet wide, increasing to as much as 600 feet in the bends. The channel is well marked by range lights and buoys, and in addition range beacons (white targets with black centers) are maintained by the U. S. Engineers. With these aids it is not difficult for a stranger of 20 feet draft to navigate the river; all sailing vessels employ a towboat for crossing the bar and in the river as far as Jacksonville.

Mayport is a village on the south bank, 3 miles inside the entrance between the jetties. It has communication by rail, small craft, telephone and telegraph with Jacksonville; and coal and water can be had at the railroad wharf, to which a draft of 19 to 22½ feet can be taken. Some supplies and gasoline can be obtained; also pilots for the inland passage.

Pilot Town is a village on the north bank opposite Mayport. Coal can be obtained here.

The city of **Jacksonville** is on the north bank of the river, 24 miles above the entrance between the jetties. Large quantities of lumber, naval stores, and produce are

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[1] Shown on chart **158**, scale $\frac{1}{80,000}$; **577**, scale $\frac{1}{40,000}$, price of each, $0.50.

[2] Shown on charts **158**, scale $\frac{1}{80,000}$; **577**, scale $\frac{1}{40,000}$; price of each $0.50. The river above Jacksonville is shown on charts **455b**, **455c**, **455d**, scale $\frac{1}{40,000}$, price of each $0.40; **508**, **509**, scale $\frac{1}{40,000}$, price of each $0.25; **458**, scale $\frac{1}{80,000}$, price $0.40.

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shipped to northern ports. The city has railroad communication, and steamboat communication with northern ports and with up-river landings as far as Enterprise and Sanford, a distance of 128 miles.

Prominent features.—Mount Cornelia, 63 feet high and thickly wooded, is about 2 miles northward of the entrance. St. Johns River lighthouse, on the south side of the entrance, is a red brick, conical tower. The light is fixed white, 77 feet above the water, and visible 15 miles. About 3¾ miles south of the entrance is the large hotel and chimney at Atlantic Beach.

Pilots will generally be found cruising outside the bar, or they will come out to a vessel making signal for one. The bar pilots keep a lookout for approaching vessels. Up-river pilots can be obtained at Jacksonville. Bar pilotage is compulsory for certain vessels. For pilot rates, see Appendix I.

Towboats are usually stationed at Mayport or Pilot Town ready to go out to any vessel making signal outside the bar; they can always be had at Jacksonville for towing up or down the river.

Quarantine.—The quarantine station is at Mayport. Vessels subject to visitation by the quarantine officer must wait to be boarded below the quarantine flag, which is displayed at the station. The local call for the quarantine officer is 1 long, 1 short, and 1 long blasts on a steam whistle.

Hospital.—At Jacksonville there is a relief station of the United States Public Health Service.

Anchorages.—Vessels waiting outside the bar generally anchor, if the wind and sea are not too heavy, in the vicinity of the gas and whistling buoy; or they can anchor, in about 6 fathoms, about 3 miles northeastward of St. Johns River lighthouse, with the end of the north jetty bearing about south.

The best and usual anchorage inside the mouth of the river is abreast Mayport, where a basin 800 feet wide with a least depth of 27 feet has been dredged on the west side of the channel. Buoy No. 4 marks the lower (north) end of the basin, and the wharves at Pilot Town its western edge.

Anchorage is not permitted in the river at Jacksonville between Hogan Creek and the Florida East Coast Railroad bridge, except for small craft on the south side of the river; large vessels can anchor below Hogan Creek. A good anchorage at Jacksonville for yachts is above the railroad bridge off Winter (Lancaster) Point.

Supplies.—Provisions can be obtained at Jacksonville and Mayport. Ship chandler's stores, anthracite and bituminous coal, and water can be obtained alongside the wharves at Jacksonville. Bituminous coal and water can be had at the railroad wharf at Mayport, and coal at Pilot Town.

Repairs.—There are a number of dry docks and marine railways. The dimensions of the largest dock are: Length 330 feet, width 65 feet, depth over sill 20 feet; capacity, 4,500 tons. The facilities for repairs to vessels and machinery of steamers are excellent.

Wharves.—The depth of water alongside the wharves at Jacksonville is 12 to 24 feet, according to locality; at the railroad wharf at Mayport 22½ feet; and 18 feet at the coal wharf at Pilot Town. The facilities for loading and discharging cargoes are good.

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Storm warning displays are made on one of the high buildings at Jacksonville, and are visible from the river. They are also displayed at Mayport, but do not show well to vessels at any distance outside the bar.

Tides.—For tides at Fernandina see the tide tables for the Atlantic coast of the United States, published annually in advance by the Coast and Geodetic Survey, in which the tides are predicted for every day of the current year. At the entrance between the jetties of St. Johns River high water occurs 1h. 3m. and low water 46m. before high and low water, respectively, at Fernandina. Proceeding up St. Johns River, high and low water occur later than at the entrance, as follows: Mayport, 41m. and 43m.; Fulton, 1h. 9m. and 1h. 21m.; New Berlin, 1h. 21m. and 1h. 42m.; Cummer Mill, 1h. 38m. and 1h. 57m.; Jacksonville, 2h. 6m. and 2h. 12m.

The time of high and low water at points on the river can be conveniently obtained by applying the following values to the predicted times given in the tide tables for Fernandina: Entrance between jetties, high water 1h. 3m. before, low water 46m. before; Mayport, high water 22m. before, low water 3m. before; Fulton, high water 6m. after, low water 35m. after; New Berlin, high water 18m. after, low water 56m. after; Cummer Mill, high water 35m. after, low water 1h. 11m. after; Jacksonville, high water 1h. 3m. after, low water 1h. 26m. after.

The mean rise and fall of the tides is as follows: Entrance between jetties, 5.2 feet; Mayport, 4.3; Fulton, 2.9; New Berlin, 2.1; Dame Point, 1.8; Cummer Mill, 1.1; Jacksonville, 0.8.

Currents.—There are strong tidal currents in St. Johns River as far up as Dame Point. The currents at the entrance between the jetties require special attention. With northerly winds there is a strong southerly set on the flood at the end of the north jetty, and the conditions here are often dangerous, especially in heavy weather; in the event of a vessel becoming unmanageable, either by taking the ground or a break in the steering gear, she is almost certain to be driven on one of the jetties and become a total loss. The mean velocities in the channel at the strength of the current are as follows: Mayport, ebb 2.4 knots, flood 1.9; Long Island, ebb 1.7, flood 1.3; Dame Point, ebb 1.4, flood 1.3. The velocity of the flood is increased by northeasterly and easterly winds, and the ebb by southwesterly and westerly winds.

Slack water occurs later than the time of local high and low waters, as follows: Entrance between jetties (estimated), high water 1h. 7m., low water 1h. 55m.; Mayport, high water 1h. 48m., low water 2h. 38m.; Fulton, high water 2h. 4m., low water 2h. 34m.; New Berlin, high water 2h. 9m., low water 3h. 5m.; Cummer Mill, high water 3h. 52m., low water 4h. 40m.; Jacksonville, high water 2h. 57m., low water 4h. 8m.

The tidal currents set in the direction of the channel, except on the crossing from Fulton to the mouth of Clapboard Creek, where there is some set on the ebb from the channel between Fulton and Le Barons Island, and on the flood into the sloughs northeastward of Le Barons Island.

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DIRECTIONS, ST. JOHNS RIVER TO JACKSONVILLE.

The channel from sea to Jacksonville is a dredged cut from 300 to 600 feet wide, the tidal currents have considerable velocity, and strangers are advised to take a pilot. The ranges mentioned in the following directions mark the axis of the cut. Unless with a local pilot, vessels do not run the river at night; sailing vessels require a towboat.

1. FROM NORTHWARD.—From Brunswick light vessel a 194° true (S by W ¼ W mag.) course made good for 37½ miles will lead to St. Johns gas and whistling buoy. The principal danger in the northern approach to St. Johns River is the bar at the entrance of Nassau Sound, on which a number of vessels have been lost in recent years. In each case the vessel was standing in for the coast on a southwesterly course, obtained a sounding of over 9 fathoms (high water) in the deep hole a short distance outside the bar, and stranded before obtaining another sounding. A contributory cause for the disasters is the prevailing northerly current, which is felt until well inside the 10-fathom curve except with northeasterly or northerly winds. The bar is marked off its northeast side by a nun buoy. St. Johns River is so well marked by the lighthouse, the jetties, and usually a number of vessels outside the bar, that it is unnecessary to get in dangerously close to the coast to recognize the entrance.

1A. FROM SOUTHWARD.—Approaching Cape Canaveral from southward, the 15-fathom curve is a good guide. Rounding Cape Canaveral in a depth of 15 fathoms will lead about 15 miles off the light and in sight of it on a clear night. Passing about 5 miles eastward of Hetzel Shoal gas and whistling buoy a 333° true (NNW ½ W mag.) course made good for 117 miles will lead to a position 2 miles eastward of St. Johns gas and whistling buoy; the course if made good leads within the limits of visibility of Mosquito Inlet and St. Augustine lights. On this course a set due to the prevailing current may be expected, except with northerly or northeasterly winds, of ½ to ¾ knot in a northerly direction parallel with the coast. Broken ground with least depths of 5 to 6 fathoms lies from 4 to 6 miles from the coast for a distance of 15 miles northward of St. Augustine lighthouse. With this exception the coast southward of St. Johns River is clear, and it is better to make the coast southward than northward of the entrance.

Bound southward from St. Johns River vessels, except deep-draft ones, can avoid the northerly set due to the prevailing current by following the coast at a distance of about 3 miles to abreast Mosquito Inlet lighthouse, and then shaping the course to pass outside of Hetzel Shoal gas and whistling buoy.

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2. FROM SEA TO MAYPORT.—From St. Johns gas and whistling buoy the course on the line of the *Wards Bank range lights* (skeleton structures, half black, half white) is 276° true (W ½ N mag.). When up to the outer black buoy off the bar keep northward of the range until up to the gas and bell buoy off the end of the North Jetty, and then follow the range closely, passing about midway between the north jetty and the black buoys.

When ⅜ mile inside the end of the jetty steer 255° true (WSW ⅝ W mag.) with *Crossover range lights* (skeleton structures, half black, half white) in line ahead. When nearly abreast gas buoy No. 6 steer 289° true (WNW ⅜ W mag.) with *Fort George Island range lights* (white pile structures) in line ahead. When abreast can buoy No. 1, starboard gradually and steer 245° true (SW by W ¾ W mag.) with *Magic City range lights* (white skeleton structures) in line astern. Pass eastward of nun buoy No. 4 and then steer 201° true (S by W ⅞ W mag.) with *Pilot Town range lights* (pile structures, red daymarks) in line astern. Anchorage can be had on the west side of the channel after passing nun buoy No. 4.

3. MAYPORT TO BROWNS CREEK.—Pass about 100 yards from the railroad wharf, steer 235° true (SW ¾ W mag.), and leave *Mile Point light No. 2* (pile structure, red daymark) 150 yards on the starboard hand. When this light is abaft the beam, steer 260° true (W by S mag.) with *Mile Point Cut A range lights* (white pyramidal structures) in line ahead.

Continue on this range for ⅜ mile and then steer 290° true (WNW ¼ W mag.) with *Mile Point Cut B range lights* (white pyramidal structures) in line ahead. Continue on this range for ⅜ mile and then steer 306° true (NW ¾ W mag.) with *Training Wall range lights* (red, square daymarks) in line ahead. When abreast can buoy No. 9, steer 289° 30′ true (WNW ¼ W mag.) with *Sister Creek light* (red pyramidal structure) in range with *Mile Point light No. 2* (pile structure, red daymark) astern.

Continue on this course for nearly ¼ mile until abreast buoy No. 11, and then starboard gradually and steer 247° 30′ true (WSW mag.) with *White Shells Cut range lights* (front, pile structure, red daymark; rear, white pyramidal structure) in line astern. Continue on this course, passing in mid-channel southward of *St. Johns Bluff light No. 4* (pile structure, red daymark), and then follow the south bank of the river at a distance of about 125 yards.

When abreast *Fulton light No. 1A* (white daymark on south bank), steer 338° true (NNW mag.) with *Little Marsh Island Channel range lights* (front, red, square daymark; rear, white pyramidal skeleton) in line ahead.

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Continue on this course until 400 yards from the front light and then steer 318° true (**NW ¼ N** mag.) with two targets in line ahead, leaving light No. 6 about 150 yards on the starboard hand. Then steer 299° true (**NW** by **W ½ W** mag.) with *Clapboard Creek range lights* (front, red, square daymark; rear, white pyramidal skeleton) in line ahead. On approaching the front light (No. 8) leave it nearly 100 yards on the starboard hand and follow the directions in section 4.

4. BROWNS CREEK TO CEDAR CREEK.—From light No. 8 follow the north bank of the river at a distance of about 100 yards, passing beacon No. 5 and *New Berlin Cut range front light No. 10* (red, square daymark) at a distance of about 250 feet. Then bring this light in range astern with *New Berlin Cut range rear light* (white, pyramidal skeleton) on a 209° true (**SSW ½ W** mag.) course. Follow the bank at New Berlin at a distance of 100 yards, leave *Lower Quarantine Shoal light No. 7* (pile structure, black daymark) 75 yards on the port hand, and head for *Quarantine Island light No. 7A* (black skeleton structure) on a 188° true (**S ⅝ W** mag.) course; two targets will also be in range ahead.

Pass about 100 yards from Quarantine Island light No. 7A and follow the curved channel westward around Dame Point, leaving *Dame Point light No. 16* (close to Dame Point) about 100 yards on the starboard hand and *Dame Point Dredged Cut light No. 9* (black, square daymark) 100 yards on the port hand. Then steer 326° true (**NW ⅞ N** mag.) with *Dunn Creek range lights* (front, pile structure, white square daymark; rear, pyramidal skeleton, white daymark) in line ahead; two targets will be in range astern. When past beacon No. 11, steer 316° 30′ true (**NW ⅛ N** mag.) with *Cedar Creek range lights* (front, square white daymark; rear, skeleton, white daymark) in line ahead.

When abreast *Dunn Creek light No. 13* (pile structure, black daymark), steer 307° true (**NW ¾ W** mag.) with two targets in range ahead until *Cedar Creek range front light No. 20* (pile structure, white daymark) is abeam, distant 200 feet. Then steer 287° 30′ true (**WNW ½ W** mag.) with two targets in range ahead until *Curved Channel light No. 15* (pile structure, black daymark) is abeam, distant 200 feet. Then steer 269° true (**W ⅛ S** mag.) with two targets in range astern until *Drummond Creek range front light* (pyramidal skeleton, white daymark) is 200 feet on the starboard beam. Then steer 250° true (**WSW ⅛ W** mag.) with two targets in range astern until *Cedar Creek light No. 17* (pile structure, black daymark) is abeam, distant 200 feet. Then follow the directions in section 5.

5. CEDAR CREEK TO JACKSONVILLE.—When light No. 17 is abeam, steer 239° true (**SW** by **W ⅛ W** mag.) with *Drummond Creek range lights* (skeleton structures, white daymarks) in line astern, leaving

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beacon No. 22 (red pile structure) 150 yards on the starboard hand. When *Trout Creek range front light* (pile structure, white daymark) is abeam, distant 250 yards, starboard gradually and steer 196° true (S by W ⅜ W mag.) with *Trout Creek range lights* (white, square daymarks) in line astern, leaving light No. 19 about 150 yards and light No. 19A about 100 yards on the port hand; the cut marked by this range is through rock, and the sides of the cut are marked by buoys.

When 200 yards past light No. 19A, steer 173° true (S ⅝ E mag.) and leave *Six Mile Creek light No. 19B* (black daymark) 125 yards on the port hand. Then head for *Steep Bank light No. 19C* (pile structure, black daymark southward of wharf) on a 129° true (SE ⅝ E mag.) course. Follow the east bank of the river at a distance of about 400 yards for nearly 1 mile, and then steer 195° true (S by W ¼ W mag.) with two targets in range astern, and leave lights Nos. 21 and 21A (pile structures, black daymarks) 100 yards on the port hand.

When *Commodore Point Shoal light No. 26* (pile structure, red daymark) is abeam, follow a mid-river course, passing southward of buoy No. 18, to the wharves at Jacksonville.

ST. JOHNS RIVER ABOVE JACKSONVILLE.

Between Jacksonville and Palatka, a distance of 47 miles, the river has been improved by dredging a channel 13 feet deep. This part of the river is comparatively easy to navigate with the aid of the chart. A draft of 9 feet can be taken to Welaka, 65 miles above Jacksonville; 7 feet to the head of **Lake George**, 85 miles; 6 feet to Sanford, 127 miles; and 5 feet to **Lake Poinsett**, 195 miles above Jacksonville, which is the present head of steamboat navigation. **Lake Washington**, 216 miles above Jacksonville, is the head of navigation.

Steamers make regular trips on the river between Jacksonville and Sanford. The principal traffic is in lumber, produce, and general merchandise. Schooners occasionally load lumber at Green Cove Springs and Palatka. There are numerous landings on the river, some of which are winter resorts, and others are centers of farming districts and orange groves. The more important places on the river are Green Cove Springs, Palatka, Welaka, Astor, and Sanford. The unimproved creeks tributary to St. Johns River are apt to be obstructed by logs and hyacinth.

McGirts Creek, 3 miles above the F. E. C. Railroad bridge at Jacksonville, is crossed by two drawbridges near its mouth. A draft of about 5 feet can be taken across the bar above the bridges into the narrower part of the creek.

Doctors Lake, 11 miles above Jacksonville, has a depth of 7 to 8 feet in the entrance, and is occasionally used as a fresh-water anchorage.

Julington Creek, 13 miles above Jacksonville, has a least depth of 5 feet for a distance of 3 miles to the forks, and the same depth can be taken about 3 miles up both branches.

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Black Creek, 18 miles above Jacksonville, is navigable for vessels of 6 feet draft about 15 miles to the village of **Middleburg**. The creek just inside its entrance is crossed by a drawbridge.

Green Cove Springs, a village on the west bank 20 miles above Jacksonville, has several sawmills. There is a depth of about 7 feet at the wharves.

Trout Creek and **Six Mile Creek** have a common entrance about 24 miles above Jacksonville. These creeks are navigable about 3 or 4 miles for boats of 6 feet or less draft.

Deep Creek, 36 miles above Jacksonville, is navigable for a draft of 7 feet for a distance of about 4 miles to **Hastings**, a town on the railroad.

Rice Creek, 44 miles above Jacksonville, is navigable for small craft of 6 feet or less draft about 5 miles to the forks and a short distance up both branches. Two drawbridges cross the creek a short distance above its mouth.

Palatka is an important town and railroad center on St. Johns River, 48 miles above Jacksonville. There are large sawmills, a manufactory of wooden tanks, a machine shop, and a railway capable of taking out vessels 125 feet long and 8 feet draft. Supplies and fresh water can be had. The depths at the wharves between the bridges are 10 to 16 feet, and a channel 12 feet deep has been dredged to the wharves just above the upper bridge. The deepest draft loaded is 14 feet. Pilots for St. Johns River and tributaries can be had here.

Dunns Creek, 6½ miles above Palatka, is navigable for boats of 6 feet draft to **Crescent Lake**, a distance of 7½ miles, and thence up the lake 6½ miles to **Crescent City**, a town with railroad communication. Supplies, ice, and gasoline can be obtained, and there is a railway for small craft. A depth of 5 feet can be taken into **Haw Creek**, at the head of Crescent Lake. The channel in Crescent Lake is marked by lights. A drawbridge crosses Dunns Creek ¾ mile above its entrance from St. Johns River. Some of the bends in the creek are sharp.

A drawbridge with a clear opening 94 feet wide crosses the river at **Buffalo Bluff**, 9¾ miles above Palatka.

Welaka is a village 18¼ miles above **Palatka**. Supplies, gasoline, and water can be obtained. A draft of 9 feet can be taken up St. Johns River to the wharf at Welaka.

Oklawaha River, 19 miles above **Palatka**, is extremely tortuous and obstructed by shoals, and the upper part above Silver Springs Run by hyacinth and eel grass. The largest vessel navigating the river is a recess-sternwheel steamboat, 80 feet long. Improvements are in progress to obtain a channel 6 feet deep for a distance of 46 miles from St. Johns River to the mouth of **Silver Springs Run** and 6 miles up the latter to the village of **Silverspring**, and 4 feet deep from the mouth of Silver Springs Run to **Leesburg**, 82 miles from St. Johns River, which is the head of steamboat navigation. In 1912 there was a well-cleared channel 6 feet deep for a distance of 28 miles from St. Johns River, a practicable channel 4 feet deep to Silver Springs Run, and a channel 3 feet deep to Leesburg. Leesburg and Silverspring have railroad communication. There is a down-stream current in the river of about 1 knot. A pilot for the river can be obtained at Palatka and sometimes at Welaka.

Astor is a village with railroad communication 5 miles above Lake George and 42½ miles above Palatka.

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Wekiva River, 72 miles above Palatka, is navigable for boats of 3½ feet draft to **Clay Springs**, a winter resort about 18 or 20 miles above its mouth.

Sanford is an important town and railroad center on the south side of **Lake Monroe**, 80 miles above Palatka.

The **channel** from Jacksonville to Palatka has been obtained partly by dredging; it is well marked by lights and beacons, and is comparatively easy to navigate with the aid of the chart. Some local knowledge is required above Palatka to follow the channel. In the upper part the river is narrow and tortuous in places, and difficulty may be experienced in making some of the bends; also vessels with masts may have some difficulty from overhanging trees.

A **pilot** for the river and its tributaries can be obtained at Jacksonville, Palatka, and Sanford.

Tides.—From Jacksonville to Palatka the mean rise and fall of tides is 0.9 foot, and the tidal action is felt to Lake George. When not affected by strong winds, the tidal currents have little velocity above Jacksonville. The winds have considerable effect on the water level and velocity of the currents. Northeast gales cause high water in the river above Jacksonville; westerly or southwesterly winds cause low water and increase the velocity of the ebb, and decrease or may interrupt the flood. The river water may be fresh at Jacksonville at low water with westerly winds; with northeasterly winds brackish water may extend up to Doctors Lake. The usual variation of water level in the upper river due to freshets is 3 feet.

COAST FROM ST. JOHNS RIVER TO CAPE FLORIDA.[1]

From St. Johns River to Miami there is an inland waterway, which parallels the coast and which is good for a draft of 4 feet; this route and the inlets are described on page 183.

From St. Johns River to Cape Canaveral the coast trends south-southeastward for 125 miles, and is broken by three unimportant inlets. The coast shows an almost continuous range of sand hills backed by woods; the woods in the vicinity of Cape Canaveral and for a distance of 17 miles northward are farther back from the beach, and consequently are less distinct when seen from seaward.

The depths along this stretch of coast are irregular. Except off St. Johns River and St. Augustine and Mosquito Inlets, 5 to 7 fathoms can be taken as close as 1 mile and 3 fathoms as close as ⅝ mile to the beach until approaching Cape Canaveral. Broken ground, with spots having 5 to 6 fathoms over them, lies from 4 to 6 miles offshore, and from 12 to 16 miles north-northeastward of St. Augustine lighthouse. There is a channel with depths of 6½ to 7¼ fathoms inside the shoal and about 2 miles from the beach. The shoals are about 8 miles long in a southeasterly direction and about 2½ miles wide.

St. Augustine lighthouse, 31 miles southward of St. Johns River lighthouse, is a black and white, spirally banded, conical tower. The light is fixed white, varied by white flashes, thus: Fixed 112.5 seconds, eclipse 31 seconds, flash 5.5 seconds,

[1] Shown in parts on charts **13, 14,** scale $\frac{1}{400,000}$; **158, 159, 160, 161, 162, 163, 164, 165,** scale $\frac{1}{80,000}$; price of each $0.50.

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eclipse 31 seconds. It is 161 feet above the water and visible 19 miles. About 200 yards northward of the lighthouse is a radio station.

Mosquito Inlet lighthouse, 52 miles southward of St. Augustine lighthouse, is a red brick, conical tower. The light is fixed white, 159 feet above the water, and visible 19 miles.

False Cape is the name given to a small part of the coast about 9 miles northward of Cape Canaveral, which it resembles when seen from seaward.

Cape Canaveral, where the coast makes a sharp bend westward, is low and sandy, and is marked by Cape Canaveral lighthouse.

Cape Canaveral lighthouse is a white and black, horizontally banded, conical iron tower. The light is flashing white (flash 4.7 seconds, eclipse 55.3 seconds), 137 feet above the water, and visible 18 miles. Vessels may communicate with the lighthouse by the International Signal Code.

Broken ground and shoals extend 13 miles northward and northeastward from Cape Canaveral, terminating in **Hetzel** and **Ohio Shoals**, which have depths of 11 and 19 feet, respectively. Hetzel Shoal gas and whistling buoy (occulting white light) is moored in a depth of 11 fathoms off the northeast side of Hetzel Shoal, about 13½ miles 34° true (**NE** by **N** mag.) of Cape Canaveral lighthouse. The least depths found on the inner shoals range from 9 to 16 feet, the shoals are subject to some change in position and depth, and only small, light-draft craft can safely pass inside the outer shoals. In a heavy sea the shoals are marked by breakers, but with a smooth sea there is nothing to indicate them except the buoys marking Hetzel and Ohio Shoals and Cape Canaveral lighthouse.

The effect of the Gulf Stream may be expected well in on the shoals, and this should be kept in mind in approaching the shoals from southward, as a vessel will generally overrun her log. Approaching from southward 15 fathoms is a good depth by which to avoid the shoals, from northward 13 fathoms.

From Cape Canaveral to Lake Worth Inlet the coast trends generally south-southeastward for 104 miles and is broken by four unimportant inlets. This section of the coast is formed almost entirely by a low narrow strip of sand, which lies at a distance of 1 to 2 miles from the mainland, from which it is separated by the shallow waters of Banana and Indian Rivers, a part of the inland waterway. From seaward the coast shows a line of sand hills partly covered with grass and scrub palmetto; behind all is the background of heavy woods on the mainland.

The coast between Cape Canaveral and Lake Worth Inlet has broken ground in places, which extends off a greatest distance of about 10 miles at **Bethel Shoal** (least depth 28 feet). Bethel shoal gas and whistling buoy (flashing white light) is moored in a depth of about 8 fathoms close eastward of the shoal and about 11 miles from shore; it lies 47 miles southward of Cape Canaveral and the same distance northward of Jupiter Inlet lighthouse. For a distance of 25 miles southward of Bethel Creek house of refuge broken ground with 3 to 4 fathoms over it extends from 2½ to 5 miles offshore. The principal danger is **St. Lucie Shoal**, with 16 to 24 feet over it, which lies from 3 to 6 miles offshore and 22 to 26 miles northward of Jupiter Inlet lighthouse. A shoal, on which the least depth found is 5¾ fathoms, lies 3 miles from shore off St. Lucie Inlet, 13 miles northward of Jupiter

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Inlet lighthouse. A depth of 6½ fathoms has been found on the shoal, which extends 3 miles from shore about 3 miles northward of Jupiter Inlet lighthouse. These shoals should be avoided by deep-draft vessels; the 15-fathom curve is a safe guide.

Jupiter Inlet lighthouse is a red-brick tower. The light is fixed white varied by white flashes (fixed 45.0 seconds, eclipse 20.7 seconds, flash 3.6 seconds, eclipse 20.7 seconds), 146 feet above the water, and visible 18 miles. Near the lighthouse are a radio station and a storm-warning display station.

From Lake Worth Inlet to Cape Florida the coast trends generally southward for 62½ miles and is broken by two unimportant inlets. This section of the coast is formed almost entirely by a low sand beach, with more or less conspicuous hills partly covered with grass and scrub palmetto, back of which it is wooded. Aside from the lighthouse the only prominent landmarks along this section of the coast are the large hotels and piers at **Palm Beach**, a popular winter resort, 14½ miles southward of Jupiter Inlet lighthouse.

The coast between Lake Worth Inlet and Cape Florida is fairly bold; the 20-fathom curve runs parallel to the beach, and for a greater part of the distance is less than 2 miles from it; inside this curve the shoaling is rapid, and 6 to 8 fathoms are found in places 1½ miles from the beach.

Hillsboro Inlet lighthouse is an octagonal, pyramidal, iron, skeleton tower, lower third white, upper two-thirds black. The light is flashing white (flash ¼ second, eclipse 9¾ seconds), 136 feet above the water, and visible 18 miles.

Cape Florida, 36 miles southward of Hillsboro Inlet lighthouse, is the southern point of Key Biscayne; it is marked by a disused lighthouse (white tower).

KEY BISCAYNE BAY AND MIAMI.[1]

Key Biscayne Bay is a large, shallow body of water, commencing in latitude 25° 55′ N. and extending in a southerly direction about 33 miles to Card Sound. For the first 10 miles the bay has a width of about 2 miles and is separated from the Straits of Florida by a narrow peninsula. For the remainder of the distance the average width of the bay is nearly 7 miles, and it is separated from Hawk Channel by a number of keys and coral banks, between which there are several narrow and shallow passages. A great part of the bay has depths of 9 and 10 feet, and there are a few places with depths of 13 to 15 feet; but near its head it is very shallow. A draft of 10 feet can be taken into the bay through what is known as Biscayne Channel, and this draft can be taken to the city of Miami.

Biscayne Channel leads from Cape Florida Shoal light (about 2 miles southeastward of Cape Florida) in a northwesterly direction and then west, through one of the slues between the reefs, into Key Biscayne Bay. This channel has been improved by dredging, but is narrow in places; it is marked by several private beacons, and has a depth of 9 feet.

The city of **Miami**, on the west shore of Key Biscayne Bay, at the mouth of Miami River, is about 7 miles northward of Cape Florida. After entering the bay the city

[1] Shown on charts **165, 166**, scale $\frac{1}{80,000}$, price of each $0.50.

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is reached through a dredged channel 2¾ miles long, 11 feet deep, and about 100 feet wide; this channel is well marked by beacons. See also page 198.

The new cut, about ½ mile north of **Norris Cut**, is used considerably by small craft bound for the fishing ground outside the keys. The approach is between two short rock jetties. A depth of 6½ feet can be carried through a narrow channel close under the end of the north jetty; but through the land cut a current of 3 to 4 knots may be found. Inside the bay a dredged cut, 10 feet deep, marked by stakes on its northern side, extends to Miami. This entrance should not be used by strangers.

DIRECTIONS, KEY BISCAYNE BAY TO MIAMI.

The following directions are good for a draft of 8 feet to Miami; a draft of about 10 feet can be taken to the city, but requires local knowledge. The partly dredged channel from Cape Florida Shoal light through Biscayne Channel is marked on the starboard hand by piles with triangular day marks and buoys, and on the port hand by piles with square day marks. At times the currents have considerable velocity and require some attention.

Vessels can follow the directions for Hawk Channel until off the entrance; or, from outside, pass close to the bell buoy 2⅝ miles northward of Fowey Rocks lighthouse and steer 288° true (**WNW ½ W** mag.) for Cape Florida Shoal light in range with Biscayne Channel light. Leave nun buoy No. 2 on the starboard hand and can buoy No. 3 on the port hand. Pass about 50 yards westward of Cape Florida Shoal light and haul a little northward keeping in the channel marked by the beacons and buoys until up to Biscayne Channel.

The course through Biscayne Channel is about 271° true (**W** mag.) with Biscayne Channel light (red structure) a little on the starboard hand. Leave the light about 200 feet on the starboard hand, and then steer 310° true (**NW ½ W** mag.), leaving the beacons on the sides indicated by their day marks, for ⅝ mile until up to a beacon with a square day mark.

From this beacon steer 4° true (**N ¼ E** mag.) for 2¾ miles, passing ¼ mile eastward of a beacon with square day mark and to a position ¼ mile westward of nun buoy No. 4; and then steer 7° true (**N ½ E** mag.) for 1¾ miles to the beacon at the entrance of the dredged channel. Then follow the dredged channel as marked by the piles (with day marks) to the turning basin in front of the railroad wharf, and then select a berth alongside of the wharf.

FLORIDA KEYS AND REEFS.[1]

The Florida Keys consist of a remarkable chain of low islands, beginning with Virginia Key, in about latitude 25° 45′ N., longitude 80° 09′ W., and extending in

[1] Shown on chart **15**, scale $\frac{1}{400,000}$; and in parts on charts **166, 167, 168, 169, 1252**, scale $\frac{1}{80,000}$; price of each $0.50.

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a circular sweep to Marquesas Keys, in latitude 24° 33′ N., longitude 82° 10′ W., a distance of nearly 145 miles. For a distance of nearly 100 miles they skirt the southeast coast of the Florida peninsula, from which they are separated by shallow bodies of water known as Key Biscayne Bay, Card Sound, Barnes Sound, and Florida Bay, which are connected in the order named. Key Biscayne Bay has a depth of 9 to 10 feet for a great part of its length; the other bodies of water are shallow, full of small keys and shoals, and of no commercial importance. Westward of Florida Bay the Florida Keys separate the Straits of Florida from the Gulf of Mexico.

No detailed description of the keys can be given and none is necessary; they are mostly of coral formation, all are low and for the most part covered with a dense growth of mangroves, though some are well wooded with pine, and on a few are groves of coconut trees; pineapples are being largely cultivated on the keys. Nearly all of the keys along the Hawk Channel are inhabited, but the only place of importance is Key West.

A railroad has been built across the keys to Key West; the openings under the viaduct and bridges are indicated on the charts. There are two drawbridges, at **Indian Key** and **Moser Channel**, through which a depth of 5 to 7 feet can be taken from Hawk Channel to Florida Bay and the Gulf of Mexico. These channels are only used by small craft which trade among the keys, and should not be attempted by a stranger without a pilot. The route along the north side of the keys from **Miami** to Bahia Honda is described on page 199.

The **currents** have a velocity of 3 to 4 knots through the openings between the keys. See also p. 38.

Florida Reefs.—The Florida Keys are skirted on the side next to the straits throughout their whole extent by the Florida Reefs, a chain of dangerous reefs and shoals lying at an average distance of about 5 miles from the line of keys. Between the chain of reefs and keys there is a passage called Hawk Channel. The reefs are more dangerous from the fact that they are not marked by breakers in smooth weather and few show above water. On the outer edge of and between the reefs the water shoals abruptly.

In approaching the reefs from seaward warning of their proximity will usually be given by a difference in the color of the water, which will change from deep blue to light green; too much dependence must not, however, be placed upon this warning. In clear weather the lighthouses and beacons make navigation along the reefs easy; in thick weather the lead must be relied upon for safety. Soundings in 50 fathoms will assure the navigator of being within about 2 to 3 miles of the reefs, and great caution should be used in approaching them closer. Fogs, however, are not frequent in this locality.

Fowey Rocks lighthouse is a dark brown, pyramidal, skeleton tower on pile foundation, inclosing a white dwelling and stair cylinder. The light is fixed white with red sectors, 110 feet above the water, and visible 16 miles.

Carysfort Reef lighthouse is a dark brown, pyramidal, skeleton tower on pile foundation, inclosing a dwelling and stair cylinder. The light is flashing white (light 6 seconds, eclipse 14 seconds), with red sectors, 100 feet above the water, and visible 16 miles.

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Alligator Reef lighthouse is a white, pyramidal, skeleton tower on black pile foundation, inclosing a white dwelling and stair cylinder. The light is flashing white and red, every third flash red (flash 2.3 seconds, eclipse 2.7 seconds), with red sectors, 136 feet above the water, and visible 18 miles.

Sombrero Key lighthouse is a brown, pyramidal, skeleton tower on pile foundation, inclosing dwelling and stair cylinder. The light is fixed white with red sectors, 142 feet above the water, and visible 18 miles.

American Shoal lighthouse is a dark brown, pyramidal, skeleton tower on pile foundation, inclosing dwelling and white stair cylinder. The light is flashing white (light 2.3 seconds, eclipse 2.7 seconds) with red sectors, 109 feet above the water, and visible 16 miles.

Sand Key lighthouse is a brown, pyramidal, skeleton tower, on pile foundation, inclosing dwelling and stair cylinder. The light is fixed white varied by a white flash (fixed 60.5 seconds, partial eclipse 25.2 seconds, flash 9.1 seconds, partial eclipse 25.2 seconds), with red sectors, 109 feet above the water, and visible 16 miles. Storm warnings are displayed at this station.

Key West lighthouse is a white conical tower. The light is fixed white, with red sectors, 91 feet above the water, and visible 15 miles.

Rebecca Shoal lighthouse is a white, square structure on a brown pile foundation. The light flashes alternately red and white (flash 1¼ seconds, eclipse 3¾ seconds), with a red sector, 66 feet above the water, and visible 14 miles.

Dry Tortugas lighthouse is a conical tower, lower half white, upper half black. The light is flashing white (light 0.5 second, eclipse 19.5 seconds), 151 feet above the water and visible 18 miles.

HAWK CHANNEL.[1]

The navigable passage inside the Florida Reefs from Cape Florida to Key West, a distance of about 127 miles, is known as Hawk Channel. It varies in depth from 10 feet to 5¾ fathoms and is ¼ mile wide at its narrowest part.

Vessels drawing 10 feet, bound southward and westward, may use this channel with great advantage, avoiding entirely the adverse current of the Gulf Stream and finding comparatively smooth water in all winds, except when passing the large openings between the reefs in southerly winds; these openings are principally between Alligator Reef lighthouse and American Shoal lighthouse. Steamers, or sailing vessels with a leading wind, may run the courses through this channel without difficulty. Sailing vessels drawing more than 7 feet are advised not to try to beat through without a pilot.

Pilots can generally be found by anchoring at Cape Florida and sending a boat up to Miami on Key Biscayne Bay, or they may be had at Key West and from the small vessels which will sometimes be found cruising among the reefs.

Strangers using this channel must anchor at night, which can be done where the bottom is soft. Where the bottom is hard the holding ground is bad, and vessels are

[1] Shown in parts on charts 166, 167, 168, 169, scale $\frac{1}{80,000}$, price of each 20 cents.

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liable to drag if it blows freshly. Following is a description of the anchorages, given in their order when approaching from northward:

Cape Florida Anchorage is a good anchorage for vessels of about 9 feet draft, and especially for small craft, just inside Cape Florida. To enter, follow the beacons of the Biscayne Channel (see directions for Key Biscayne Bay) until about 1 mile above Cape Florida Shoal light and the channel begins to bend westward, and then steer about 313° true (**NW ¼ W** mag.). Anchor about 250 yards westward of the south end of Cape Florida, with the disused light tower bearing northward of 69° true (**ENE** mag.), in a depth of 12 to 20 feet.

Fowey Rocks Anchorage is about 1¼ miles westward of Fowey Rocks lighthouse, is fairly well sheltered, and can be reached by vessels of about 14 feet draft. Vessels of this draft may follow the directions for entering Hawk Channel and anchor ¼ mile westward of Fowey Rocks beacon (spindle V); or, from outside, pass close to the bell buoy 2⅜ miles northward of Fowey Rocks lighthouse and steer 288° true (**WNW ½ W** mag.) for Cape Florida Shoal light in range with Biscayne Channel light for 1¼ miles until up with a perpendicularly striped buoy. Then steer 182° true (**S** mag.) to the anchorage.

Legare Anchorage lies between the reefs westward of Triumph Reef and 7 miles southwestward of Fowey Rocks lighthouse. The bottom is mostly hard, but there are some soft spots on which vessels may anchor and ride out a moderate gale. The entrances are not marked, and the anchorage is not used.

Bowles Bank Anchorage, with depths of 14 to 16 feet, soft bottom in places, is good in all winds, and lies ¼ to ½ mile north-northeastward of Bowles Bank south buoy (nun, No. 4 B B), lying eastward of the north end of Elliott Key.

Caesar Creek Bank Anchorage, with depths of 10 to 12 feet, soft bottom, is good in all winds, and lies on the west side of the channel between Margot Fish Shoal and Caesar Creek Bank.

Key Largo Anchorage.—Northward and westward of the perpendicularly striped buoy off the north end of Key Largo, with Carysfort Reef lighthouse bearing about 150° true (**SSE ¾ E** mag.), soft bottom in 14 feet will be found and vessels may here anchor in safety without regard to the direction of the wind.

Turtle Harbor is a well-sheltered anchorage between the reefs lying northwestward of Carysfort Reef lighthouse. The entrance from the Straits of Florida is marked by buoys, and in smooth water a vessel of 15 feet draft should have no trouble in entering. The depth in the approach ranges from 4 to 6 fathoms and at the anchorage from 4 to 4½ fathoms. The sea buoy (nun, red, No. 2 "Turtle Harbor") lies 4¾ miles 30° true (**NNE ½ E** mag.) of Carysfort Reef lighthouse. From the sea buoy a 274° true (**W ¼ N** mag.) course for 2⅛ miles will lead to a perpendicularly striped buoy. Then steer 220° true (**SW ⅝ S** mag.) for about 1 mile; pass about 100 yards westward of can buoy No. 1 and the same distance eastward of nun buoy No. 2. A south-southwesterly course will then lead about midway between nun buoy No. 4 and can buoy No. 3, and then steer about 215° true (**SW by S** mag.) to an anchorage in the vicinity of a perpendicularly striped buoy.

Tavernier Key Anchorage.—Anchorage with soft bottom, in 16 to 20 feet, will be found with Tavernier Key bearing between west and northwest, distant from ¾ to 1

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mile; or anchor in 13 to 15 feet from ½ to ¾ mile westward or northward of Triangles beacon.

Long Key Anchorage.—Soft bottom, in from 15 to 18 feet, will be found ¾ mile westward of Long Key Shoal buoy (nun, red, No. 12), but this anchorage is exposed to southerly winds.

Turtle Shoal Anchorage.—Fair anchorage in fine weather will be found in 4½ fathoms, soft bottom, ½ mile northwestward of East Turtle Shoal buoy (can, black, No. 11 E T), and also ½ mile northwestward of West Turtle Shoal buoy (nun, red and black horizontal stripes), in from 4 to 6 fathoms.

Knights Key Anchorage.—This is a good anchorage about ¾ mile southwestward of Knights Key, but it is exposed to southwesterly winds. To make this anchorage, bring Sombrero Key lighthouse astern on a 343° true (N by W ⅝ W mag.) course; anchor in 3 to 5 fathoms, sticky bottom. The westerly edge of a red sector in Sombrero Key lighthouse leads to the anchorage. The west side of Knights Key should be given a berth of about ½ mile.

Hog Key.—A narrow channel with a least depth of about 6 feet has been dredged to Hog Key, and affords a secure harbor for launches and small craft. The entrance is about ⅜ mile southward of Knights Key, and is marked by private beacons. The color of the banks is the best guide in the narrow channel.

Moser Channel, with a least depth of 7 feet, leads from Hawk Channel through a drawbridge (106 feet opening) into Florida Bay. A strong current may be found in the vicinity of the bridge, sometimes reaching a velocity of about 4 knots at strength.

Bahia Honda Harbor is now abandoned as an anchorage for vessels, and the aids are removed. The currents through the bridge have a velocity of 3 to 4 knots.

Loggerhead Key Anchorage, with a depth of 15 feet, soft bottom, is about ¾ mile eastward of Loggerhead Key and about 1 mile northward of nun buoy No. 12LK. This is a fair anchorage in all but southerly winds. When going to the anchorage pass at least ¼ mile eastward of the buoy.

West Washerwoman Anchorage, with a depth of 3¾ fathoms, soft bottom, lies 1⅛ miles 295° true (WNW mag.) of Nine-Foot Shoal light.

Saddle Hill Anchorage, with a depth of 4¼ fathoms, soft bottom, lies 1 mile 268° true (W ⅜ S mag.) of Pelican Key buoy (can, No. 19 PK). Between here and Key West there are no anchorages.

DIRECTIONS, HAWK CHANNEL.

The following directions are good for a draft of 9 feet with daylight and moderately smooth sea. A draft of 11 feet has been taken through Hawk Channel, but it requires local knowledge and a smooth sea. A detailed description of the dangers in Hawk Channel is impracticable as well as useless; the navigator must rely wholly upon the charts and aids. The beacons and buoys can not always be distinguished by their color, as they are soon discolored by the sea birds which alight on them. There are also a number of beacons (spindles with vanes) which are intended for the guidance of vessels skirting along outside the reefs. The flood current has a north-

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westerly or northerly set, and the ebb a southerly or southeasterly set; the normal velocity of the currents is about ½ knot, but this may be increased considerably by strong winds. The currents have their greatest velocity abreast of the openings between the keys.

BISCAYNE SHOAL TO FOWEY ROCKS, 15 MILES.—Pass ½ mile eastward of Biscayne Shoal buoy (nun, No. 2), lying 1 mile offshore and 11⅛ miles northward of Cape Florida, and steer 187° true (**S ½ W** mag.) for 9 miles, passing about ½ mile westward of Florida Reefs north end gas buoy, and to a perpendicular striped can buoy, which lies 2⅞ miles 54° true (*NE ⅝ E* mag.) of Cape Florida disused light tower. Then steer 185° true (**S ⅜ W** mag.) for 6¼ miles, passing close to a perpendicularly striped buoy lying 1 mile east-southeastward of Cape Florida Shoal light, and to a perpendicularly striped buoy lying 1½ miles westward of Fowey Rocks lighthouse.

FOWEY ROCKS TO BASIN HILL BEACON, 25 MILES.—From the perpendicularly striped buoy, 1½ miles westward of Fowey Rocks lighthouse, steer 188° 30′ true (**S ⅝ W** mag.) for 2⅛ miles to nun buoy No. 2. Then steer 195° true (**S by W ¼ W** mag.) for 3⅛ miles, leaving can buoy No. 3 BB about 100 yards on the port hand and to a position 100 yards eastward of nun buoy No. 4. Then steer 207° true (**SSW ¼ W** mag.) for 1⅜ miles to nun buoy No. 4 BB; Bache Shoal beacon (black, white slats) will then be over ⅜ mile distant on the port beam.

From nun buoy No. 4 BB steer 195° 30′ true (**S by W ¼ W** mag.) for 6¼ miles; leave nun buoy No. 6 MF about 150 yards on the starboard hand, a perpendicularly striped can buoy close-to, and nun buoy No. 6 about 150 yards on the starboard hand. From nun buoy No. 6 steer 202° true (**S by W ⅞ W** mag.) for 2⅜ miles to nun buoy No. 6 OR. From nun buoy No. 6 OR steer 214° true (**SSW ⅞ W** mag.) for 9⅛ miles; leave a perpendicularly striped can buoy close-to, and Basin Hill beacon (black structure, white slats) about 100 yards on the port hand.

BASIN HILL BEACON TO HEN AND CHICKENS SHOAL BUOY, 22 MILES.—Passing 100 yards westward of Basin Hill beacon steer 210° true (**SSW ½ W** mag.) for 9 miles, leaving Grecian Shoals buoy (can, No. 5) about ¾ mile on the port hand; on this course Mosquito Bank light (black, white slats) should be ahead. When the light is 1 mile distant, steer 224° true (**SW ¼ S** mag.) leaving it about ¼ mile on the port hand. Continue the course for 12 miles from Mosquito Bank light, leaving Rodriguez Key wreck buoy (nun, red and black horizontal stripes) about ⅜ mile on the starboard hand, Triangles beacon (black structure, white slats) about 200 yards on the port hand, and Hen and Chickens Shoal buoy (nun, No. 8 HC) about 300

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yards on the starboard hand. Vessels should keep northward of a line joining Mosquito Bank light and Triangles beacon to avoid a 6-foot spot about halfway between.

HEN AND CHICKENS SHOAL BUOY TO EAST WASHERWOMAN SHOAL LIGHT, 32½ MILES.—Leaving Hen and Chickens Shoal buoy 300 yards on the starboard hand, steer 238° true (**SW by W** mag.) for 15¾ miles, leaving Alligator Shoal buoy (can, No. 11) about ¾ mile on the port hand, and Indian Key buoy (nun, No. 10 IK) and Long Key Shoal buoy (nun, No. 12) each about ¼ mile on the starboard hand.

From Long Key Shoal buoy steer 246° true (**SW by W ¾ W** mag.) for 8⅝ miles, passing close to Duck Key buoy (nun, perpendicular stripes), and leaving East Turtle Shoal buoy (can, No. 11 ET) about 400 yards on the port hand. Then steer 244° true (**SW by W ½ W** mag.) for 7¼ miles, heading for *East Washerwoman Shoal light* (white slatted structure on black piles); leave West Turtle Shoal buoy (nun, horizontal stripes) about ¾ mile on the port hand. When East Washerwoman Shoal light is distant 1 mile steer 256° 30′ true (**WSW ⅝ W** mag.) and leave the light ¼ mile on the port hand.

EAST WASHERWOMAN SHOAL LIGHT TO KEY WEST—44 MILES.—Passing ¼ mile northward of East Washerwoman Shoal light continue the 256° 30′ true (**WSW ⅝ W** mag.) course for 12¼ miles past the light, passing close to Pigeon Key Bank buoy and Bahia Honda Key buoy (perpendicular stripes).

From Bahia Honda Key buoy steer 258° 30′ true (**WSW ¾ W** mag.) for 28¼ miles, leaving Logger Head Key buoy (nun, No. 12 LK) about ⅜ mile on the starboard hand; *Nine-Foot Shoal light* (pyramidal structure, horizontal stripes) about 200 yards on the port hand; West Washerwoman Shoal buoy (can, No. 17) about ½ mile on the port hand; Pelican Key buoy (can, No. 19 PK) about ⅛ mile on the port hand; and Hawk Channel Turn buoy (can, perpendicular stripes) close to.

Then steer 286° true (**WNW ¾ W** mag.) for 2 miles. Give Whitehead Point Spit buoy (nun, No. 6) a berth of 100 yards in rounding it, and steer 2° true (**N** mag.). Pass about 100 yards westward of nun buoy No. 8 and then shape the course to give the wharves a berth of about 100 yards.

KEY WEST HARBOR.[1]

This harbor is large and commodious, and one of the best anchorages for large vessels south of Chesapeake Bay. It lies northward of a broken line of the Florida Reefs in latitude 24° 33′ N. and longitude 81° 49′ 30″ W. On the eastern side of the harbor is the city of Key West, which is of some commercial importance. It is the only city

[1]Shown on charts 169, scale $\frac{1}{80,000}$, price $0.50; 584, scale $\frac{1}{30,000}$, price $0.50.

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of any size on the west and north shores of the Straits of Florida; it is the terminus of the Florida East Coast Railroad, and has steamship communication with New York, Habana, Tampa, Mobile, and Galveston, and in the winter season with Colon and Nassau. A number of steamers and small sailing vessels enter and clear from the port, over half of which are from or for foreign ports. The greatest draft of vessels coming to the port is 26½ feet and the average draft about 14 feet.

Prominent features.—When standing along about 6 miles southward of the Florida Keys, as the entrances from the southward are approached the city and Key West lighthouse will be seen near the western end of Key West Island, and Fort Taylor will show prominently a little westward of the island. The naval coal wharf and radio poles are conspicuous north of the fort. Sand Key lighthouse will be seen about 7 miles southwestward of Key West lighthouse. **East Triangle beacon** (red) is midway between the Entrance buoy of the Main Ship Channel and Key West lighthouse, and can be readily distinguished from outside the reefs. Northwestward of the harbor, and marking the entrance to Northwest Channel, is Northwest Passage lighthouse.

Channels.—There are several channels or approaches to the harbor, leading between the reefs and coral banks which surround it. These channels are easy to follow in a sailing vessel in the daytime with a leading wind, but it is not safe for a stranger to attempt to beat into the harbor.

Southeast Channel is marked by buoys and at night by the easterly edge of a red sector in Key West light; it leads over lumpy bottom with 16 to 18 feet over the coral heads and it is not recommended for vessels of over 15 feet draft. The course through the channel is 321° true (NW ⅜ N mag.) for Key West lighthouse.

Main Ship Channel has a depth of 27 feet and is being improved to secure a depth of 30 feet; it is quite narrow in places, but is well marked by buoys and lights. This channel is used by the deeper-draft steamers and by strangers.

Southwest Channel is convenient for vessels approaching from southwestward; it has a navigable depth of 24 feet if closely followed and is marked by several buoys. Vessels of 16 feet draft can make one course nearly to the anchorage on a bearing of Key West lighthouse in the daytime and by standing on the edge of a red sector of that light at night, and this is about the deepest draft of the vessels using the channel. Strangers should not attempt it at night.

Northwest Channel has been improved and in June, 1912, had a depth of 17 feet and width of 200 feet; it can be used by vessels of 15 feet draft. This channel affords a short cut from Key West Harbor to the Gulf of Mexico and is well marked.

Anchorages.—On account of the Government submarine cable, vessels are cautioned not to anchor within ½ mile of the beach on the south side of Key West Island between Fort Taylor and East Martello Tower. The best anchorage is in the inner or Man-of-War Harbor, where the depth is 4 to 4½ fathoms; this anchorage is northward of the city between coral banks, which prevent a heavy sea. Vessels can anchor anywhere off the city northward of Fort Taylor, or in the entrance to the Northwest Channel abreast of the city in 3½ to 5 fathoms, taking care, however, not to get too close to the reefs, which in some places rise abruptly at the edge of the channels. The outer anchorage, about 1 mile from Fort Taylor, with the fort bearing between 36°

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true (NE by N mag.) and 328° true (NW by N mag.), has depths of 4½ to 6 fathoms and is somewhat exposed, but is safe for vessels with good ground tackle. Small craft generally anchor in the cove on the north side of the city southward of the railroad wharf.

Quarantine.—The boarding station is near Fort Taylor; no vessel is permitted to pass above this before obtaining pratique. The quarantine anchorage is in Man-of-War Harbor northward of Fleming Key.

Pilots can always be had by making signal while outside the reefs. Pilot boats are usually cruising outside and a good lookout is kept for approaching vessels. Pilotage is compulsory for certain vessels. For pilot rates see Appendix I. Pilots for Hawk Channel can be had at Key West.

Wharves.—The depth at the wharves ranges from 10 to 26 feet, according to locality.

Supplies.—A large supply of bituminous coal is always kept on hand, and anthracite coal can be had in limited quantities. Water can be obtained, but the supply is limited at times. Provisions and ship chandler's stores can be obtained in the city.

Repairs.—There is a small marine railway 180 feet long with a lifting capacity of about 1,000 tons; vessels of 10 feet draft forward and 16 feet aft can be hauled out. Repairs to the hulls of wooden vessels can be made, and there is a machine shop where ordinary repairs can be made.

Storm warnings are displayed at Key West and at Sand Key light station.

United States Public Health Service.—The Marine Hospital is open to foreign as well as American seamen.

Tides.—The mean rise and fall of tides is 1.2 feet.

Currents.—The tidal currents in Key West Harbor and Northwest Channel set fair with the channels and are nearly simultaneous, the strength of the flood (north flowing) occurring 1 h. 46 m. before high water, and the ebb 1 h. 14 m. below low water, at Key West. Slack water occurs 1 h. 20 m. and 1 h. 52 m., respectively, after high and low water at Key West. The average velocity at strength of both flood and ebb is 1 knot between Whitehead Spit and Kingfish Shoals, 1 knot in Man of War Harbor and 1.7 knots at its entrance, and 1.4 knots in Northwest Channel abreast of Middle Ground. These normal conditions are greatly modified by winds.

Winds.—The prevailing winds are easterly, the strongest north in winter and easterly during the hurricane months.

DIRECTIONS, KEY WEST HARBOR.

MAIN SHIP CHANNEL.—This channel has been examined by means of a wire drag and is used by all deep-draft vessels entering Key West.

There is a least depth of 27 feet on the range line, which is found ¾ mile inside the entrance gas buoy; there is a depth of 25 feet at this point 100 yards westward of the range line, and nearly ¼ mile farther northward a depth of 24 feet is found 150 yards eastward of the range line; the shoals with less than 30 feet lying just eastward of the range line are being removed. The entrance gas buoy lies 4¼ miles eastward of Sand Key lighthouse.

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The front light of the *Main Ship Channel range* is mounted on a small white pyramidal, horizontally slatted beacon on the shore end of the causeway leading to Fort Taylor; the rear light of the range is mounted on a pyramidal, horizontally slatted structure which surmounts the buoy shed on the Lighthouse Service wharf; the structure is black with a white stripe on the seaward face extending down the roof and side of shed. Each of these beacons shows a red light at night.

From entrance gas buoy steer 356° true (**N** ⅝ **W** mag.) with Key West (Main Ship Channel) range lights in line ahead, passing close to a perpendicularly striped nun buoy. Continue the course and leave can buoys Nos. 1 and 3 on the port hand and nun buoy No. 2, *Eastern Triangle beacon* (red structure), and nun buoy No. 4 on the starboard hand. When nun buoy No. 4 is abeam steer 333° true (**NNW** ⅝ **W** mag.) with Whitehead Point Spit buoy (nun, No. 6) a little on the starboard bow.

Leave nun buoy No. 6 about 200 yards on the starboard hand and steer 2° true (**N** mag.), passing can buoy No. 11 and nun buoy No. 8 at a distance of about 200 yards. Continue the course ⅜ mile past the latter buoy, and anchor in 4 to 5 fathoms. Or, from abreast nun buoy No. 8 steer 28° true (**NNE** ¼ **E** mag.) and give the wharves a berth of about 100 yards.

NORTHWEST CHANNEL FOR VESSELS OF 15 FEET DRAFT IN THE DAYTIME.—When Northwest Passage lighthouse is distant 7 or 8 miles, bring it to bear 182° true (**S** mag.) and steer for it, passing about 1¼ miles eastward of Smith Shoal whistling buoy, and until up to the entrance bell buoy. Northwest Bar light will then be in range with Sand Key lighthouse, the latter barely showing over Snipe Key.

Leaving the bell buoy close-to on the port hand steer 175° true (**S** ⅝ **E** mag.) for Northwest Bar light and pass about midway between the red and black buoys until ⅜ mile from Northwest Bar light and abreast buoy No. 4. Then leave can buoys Nos. 5 and 7 about 200 feet on the port hand, steer 115° true (**ESE** mag.), and pass midway between buoys Nos. 9 and 6.

Passing about 100 yards eastward of the latter buoy steer 137° true (**SE** mag.) for 2¼ miles to a perpendicularly striped nun buoy, passing about 100 yards westward of buoy No. 11. Then steer 152° true (**SSE** ¾ **E** mag.), pass about 100 yards westward of buoy No. 13, and continue the course to Inner Mid-channel buoy, which lies 350 yards southwestward of Middle Ground light. A 129° true (**SE** ¾ **E** mag.) course will then lead in a depth of 15 feet over the southern end of Middle Ground, passing southward of buoy No. 15. Then steer more eastward and anchor, or stand for the city wharves, leaving buoy No. 13 on the port hand.

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ALBEMARLE SOUND [1]

is 46 miles long, and has a width ranging from 11 miles near its eastern end to 3 miles about 9 miles from its western end. This sound has a good navigable depth for any vessel that can enter through the canals, and with its numerous tributaries forms the approach to a number of towns and landings, from and to which several steamers, barges, and a number of small sailing vessels are engaged in the carrying trade.

The eastern end of the sound, which is separated from the Atlantic by the narrow beach about 15 miles northward of Bodie Island lighthouse, is connected northward with Currituck Sound, and southward with Croatan and Roanoke Sounds, and by the latter sounds with Pamlico Sound. The water in the sound westward of Laurel Point lighthouse is usually fresh or slightly brackish.

The shores of the sound are low and generally wooded; there are no prominent natural features. The more important towns on the tributaries of Albemarle Sound are: Elizabeth City, on the Pasquotank River; Hertford, on the Perquimans River; Edenton, on Edenton Bay; Winton, on the Chowan River; Plymouth and Jamesville, on the Roanoke River; Columbia, on the Scuppernong River; and there are also numerous landings.

Supplies can be obtained at these towns, and there are marine railways at Elizabeth City. The rise and fall of the water level depends on the direction of the winds.

A railroad trestle crosses Albemarle Sound about 5 miles from its western end. There are two openings for vessels; one lying 1½ miles from the north shore is a lift bridge with a clear opening 140 feet wide, and is marked by a bell struck by hand during thick or foggy weather; the other lying 1 mile from the south shore is a swing bridge with clear openings 35 feet wide. There are also girder spans about ½ mile apart in the trestle, under which launches without masts can pass.

DIRECTIONS, ALBEMARLE SOUND.

The sound is comparatively free from dangers to vessels of the draft that navigate it. There are shoals making from the shore and the points along the shore of the sound. These can generally be avoided by giving the shore, and especially the points, a berth of at least 1 mile. From March to May, inclusive, the shoals in the sound are full of fish stakes and nets, especially along the north shore, where it is difficult to avoid them.

Directions for entering the sound by the inland passages through the canals and North and Pasquotank Rivers, and thence through the sound to Croatan Sound are given on pages 153–158.

From North River entrance buoy a 252° 30′ true (WSW ⅞ W mag.) course made good for 29 miles will lead nearly 2 miles southward of Wade Point lighthouse, ¾ mile southward of Reeds Point light, ¾ mile northward of Laurel Point lighthouse, and ¾ mile southward of the red buoy off Bluff Point. After passing this buoy bring Laurel Point lighthouse astern on a 264° true (W ⅛ S mag.) course, which made

[1] Shown on charts 1228, 1229, scale $\frac{1}{80,000}$, price of each $0.50.

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good for 6 miles will lead to the lift bridge in the trestle crossing the sound. From the bridge directions to Edenton Bay are given under that heading.

From Pasquotank River vessels of 7 feet or less draft with a smooth sea can cross the shoal at the entrance on a 180° true (S ⅜ W mag.) course with Poquoson Point light astern. Then bring Wade Point lighthouse astern on a 244° true (WSW ⅛ W mag.) course, which made good for 10 miles will lead to a position ¾ mile southward of Reeds Point light. Thence a 252° 30′ true (WSW ⅞ W mag.) course will lead up the sound as in the preceding paragraph.

PASQUOTANK RIVER[1]

is on the north side of Albemarle Sound, and is marked at its entrance by Wade Point lighthouse which lies 4 miles westward of North River entrance. The deeper entrance is eastward of Wade Point lighthouse; but with a smooth sea vessels of 7 feet draft can cross the shoal westward of the lighthouse, taking care, however, to give Wade Point a berth of over 1 mile, or to keep Poquoson Point light bearing westward of 0° true (N ⅜ E mag.). The river is more particularly described in connection with the inland passage on pages 151, 156.

LITTLE RIVER

is on the north side of Albemarle Sound 10 miles westward of Wade Point lighthouse. The channel is about ¼ mile wide between the shoals at the entrance, and is buoyed. The river has a general northwesterly trend to the village of Nixonton, which is on the east bank 7 miles above the entrance. About 7½ feet is the deepest draft that can be taken up to the village. Spits, with little water over them and generally steep-to, make out some distance in places from the shores and especially off the points.

DIRECTIONS, LITTLE RIVER.

Pass 100 yards eastward of the black buoy at the entrance, steer 282° true (WNW ½ W mag.) and pass close westward of buoy No. 2. Then keep near the middle of the river until abreast the point on the east bank just above Trueblood Point, and then favor the eastern bank to Nixonton.

Approaching from westward pass ½ mile southward of Reed Point light and steer 52° true (NE by E mag.) until up with the horizontally striped buoy lying southward of the entrance. Pass 200 yards eastward of this buoy, and steer about 344° true (N by W mag.) with the black buoy at the entrance on the port bow.

PERQUIMANS RIVER

is on the north side of Albemarle Sound, its entrance lying 3 miles northwestward of Reeds Point light. For a distance of 10 miles to the town of Hertford, the river is from ¾ to 1½ miles wide and has a navigable depth of 9 to 11 feet. The river then becomes narrow and crooked, but is navigable for vessels of 7 feet draft to the closed

[1] Shown on charts 407, scale $\frac{1}{60,000}$, price $0.20; 1228, scale $\frac{1}{80,000}$, price, $0.50.

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bridge at **Belvidere**, about 12 miles above **Hertford**. A drawbridge crosses the mouth of the narrow part of the river at Hertford, and the wharves of the town are above the bridge. The town ships some lumber by railroad and barges. Gasoline and other supplies can be obtained.

DIRECTIONS, PERQUIMANS RIVER.

Pass about ⅜ mile southwestward of Reeds Point light and steer about 302° true (**NW ¾ W** mag.) for 4¼ miles to buoy No. 1, lying near the middle of the entrance to the river. Or, approaching from westward, pass ¼ mile southward and eastward of the horizontally striped buoy lying southward of the entrance, and steer 1° true (**N ½ E** mag.) with buoy No. 1 on the port bow.

Pass about 100 yards northeastward of buoy No. 1 and steer 296° true (**NW by W ¼ W** mag.) for 2½ miles with Grassy Point a little on the port bow to a position 150 yards northeastward of buoy No. 3. Then steer 285° true (**WNW ¼ W** mag.) for 1¾ miles to a position 200 yards southwestward of Grassy Point light. Then steer 312° true (**NW ⅛ N** mag.) for about 5 miles heading for Ferry Point which shows as a wooded head on the northeastern side of the river. Anchor about 300 yards southwestward of Ferry Point in a depth of about 9 feet; there is not room for anchorage above this point.

The entrance to the narrow part of the river at Hertford is through a dredged channel 200 feet wide and 9 feet deep, which has a 299° true (**NW by W** mag.) direction, the middle of the channel lying 200 yards from the point on the west side below the bridge. When on the line of the face of the bulkhead below the bridge the course should be changed for the draw. There are stumps on both sides of the dredged channel.

EDENTON BAY

is a small bay on the northern side near the western end of Albemarle Sound, about 2 miles westward of the railroad trestle which crosses the sound. The entrance and channel are marked by buoys and range lights. The depth in the channel is 8½ to 10 feet, partly obtained by dredging. The large water tank just westward of the rear range light is the most prominent object seen from the sound.

Edenton is a town at the head of the bay about 1½ miles above the entrance; it has railroad communication with Norfolk, and small steamers trade to points in the sound and its tributaries. Some lumber is shipped by railroad and in barges. A towboat is stationed here. Supplies, ice, gasoline, coal, and water can be obtained. The river water is fresh and suitable for boilers. The wharf on which the front light is located has but little water alongside. Vessels can go to the wharves just westward of the range, and also to the railroad wharf at the northwest end of the harbor. The railroad wharf now in use is at the northeast end of the harbor, and is reached through a channel about 100 feet wide which is marked on the north side of its entrance, near the wharves, by a stake light.

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The inner anchorage, which is small and has a depth of 9 feet, is close eastward of the range line and about 250 yards southward of red buoy No. 6. The larger anchorage is on the west side of the range line and about midway between red buoys Nos. 2 and 4.

DIRECTIONS, EDENTON BAY.

From the lift bridge in the trestle crossing Albemarle Sound steer 333° true (**NNW** mag.) for nearly 3 miles, passing westward of the red buoy off Horniblow Point and with buoy No. 2 at the entrance of Edenton Bay on the starboard bow. When the Edenton Harbor range lights, which show just eastward of a prominent water tank, are in line, bearing 12° true (**N** by **E** ½ **E** mag.), steer for them and be guided by the range and buoys until up to the wharves.

CHOWAN RIVER

empties into the western end of Albemarle Sound from northward, and with its tributaries is one of the largest rivers in North Carolina. For a distance of 17 miles above its mouth the river has an average width of about 1½ miles. In this part of the river large areas of tree stumps, many of which are under water, are generally found on the shoals; **Stumpy Reach** is the name applied to the worst place between Colerain Landing and the mouth of Bennett Creek, a distance of 6 miles, where stumps occur on shoals with depths of about 12 feet or less. Above this the river is much narrower, but has a good channel with a depth of 9 feet for 50 miles above its mouth. **Colerain Landing** is on the west bank 12 miles above the entrance; the village of **Colerain** is on the hill ½ mile inland. **Winton**, a small town, is on the west bank of the river about 37 miles above its mouth.

Meherrin River joins the Chowan from westward about 2½ miles above Winton. The river is navigable for vessels of about 7 feet draft for a distance of 9½ miles to the village of **Murfreesboro**. The width of the river is 100 to 350 feet.

The junction of the Blackwater and Nottoway Rivers is about 13 miles above Winton. **Blackwater River** is navigable for vessels of 8 feet draft for a distance of 11 miles to the bridge at the town of **Franklin**. The width of the river is 100 to 250 feet.

Nottoway River is navigable for vessels of 8 feet draft, when the river is not low, for a distance of 13 miles to **Munroe Ferry**; a draft of 4 to 5 feet can be taken up to the ferry at any time of the year. The head of navigation for vessels is at the closed bridge of the Seaboard Air Line Railroad, 4½ miles above Munroe Ferry. Above this bridge navigation is limited by bars, snags, and closed bridges to flat boats and rafts of 2 feet or less draft.

It is advisable for a stranger to take a pilot at Edenton or at the mouth of the river.

ROANOKE RIVER[1]

empties into the southwestern end of Albemarle Sound. The shallow bight at the mouth of the river is known as **Batchelors Bay**, and near its eastern part, off the mouth of the river, is Roanoke River lighthouse. There are stumps on the shoals at the mouth of the river. Roanoke River from the confluence of **Staunton** and **Dan Rivers**

[1] The entrance is shown on charts **1228**, scale $\frac{1}{80,000}$, price $0.50; **409**, scale $\frac{1}{30,000}$, price $0.10.

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is 170 miles long to its mouth, and is the approach to a number of small towns and villages to which steamboats run. The river is navigable eight months of the year for vessels of 8 feet draft to Palmyra; a depth of 8½ feet at low water can be taken up to Hamilton all the year and 4 feet to Weldon, the head of navigation.

The principal landings on the river and their approximate distances above its mouth are: **Plymouth**, 6 miles; **Jamesville**, 15½ miles; **Williamston**, 31 miles; **Hamilton**, 54 miles; **Palmyra**, 72 miles; **Edwards Ferry**, 90 miles; **Halifax**, 102 miles; and **Weldon**, 112 miles.

The river is subject to frequent and sudden freshets, which overflow large areas of the lowland on both of its banks. Sailing vessels seldom go above Plymouth unless they are towed, the upper part of the river, on account of its width and crooked course, being navigated by steamers.

It is advisable for a stranger to take a pilot at Edenton.

MACKAY CREEK

is on the south side of Albemarle Sound just westward of the railroad trestle which crosses the sound. A channel 140 feet wide and 9 feet deep was dredged through the bar at the entrance, but it has narrowed and shoaled a little; it is marked on each side by rows of piles. There are stumps in places on the shoals at the mouth of the creek. **Mackay Ferry** is a post village ½ mile above the entrance. A railroad bridge (width of draw 35 feet) crosses the creek just inside the entrance and a highway bridge (width of draw 31 feet) crosses at Mackay Ferry. The creek is navigable for vessels to a closed bridge 8 miles by water or 3½ miles by land above Mackay Ferry; to this bridge the creek is 180 to 90 feet wide and 20 to 12 feet deep. Above this bridge to a dam at the post office of **Roper**, a distance of 2½ miles by water or ½ mile by land, the creek is 90 to 30 feet wide and 12 to 3 feet deep.

BULL BAY AND SCUPPERNONG RIVER.

Bull Bay is the western part of the bight in the south shore of Albemarle Sound southeastward of Laurel Point lighthouse. A buoyed channel leads through the shoals which obstruct the entrance, but a stranger should sound out the channel before attempting it. Several small creeks empty into the western side of the bay, none of which is navigable except for boats. A channel, with a depth of 8 feet when the water is high, leads through flats to the entrances of these creeks.

Scuppernong River empties into the eastern end of Bull Bay from southeastward. This river has been improved and is navigable for vessels of 7 feet draft a distance of about 20 miles to **Spruill Bridge**, and 5 feet can be carried 2½ miles farther to the head of navigation at the town of **Cherry**. **Columbia**, to which a draft of 7 feet can be taken, is a village 4½ miles above the mouth of the river. Columbia has communication by railroad and steamer, and some supplies, anthracite coal, and gasoline can be obtained; storm warnings are displayed.

Four drawbridges cross the river between Columbia and Cherry, the two at Columbia having clear openings 39 feet wide, and those above 30 feet; a closed bridge 6 feet above low water crosses at Cherry. A channel 150 feet wide and 6½ feet deep leads through the bar at the entrance from Bull Bay; this channel is marked by buoys and range lights. The buoy at the entrance of the channel lies 4⅜ miles 134° true (**SE ¼ S** mag.) of Laurel Point lighthouse.

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DIRECTIONS, SCUPPERNONG RIVER.

Approaching Scuppernong River from eastward, avoid the shoal with little water over it which extends about ¾ mile from the south shore of Albemarle Sound. Approaching from westward pass ½ to ¾ mile northward and eastward of Laurel Point lighthouse, and steer 142° true (**SE** by **S** mag.) for 4⅜ miles to the entrance buoy.

Then steer 132° true (**SE** ⅛ **S** mag.) through the dredged cut, keeping Scuppernong River range lights in line ahead, and passing the buoys marking the sides of the cut at a distance of about 75 feet. Pass 100 feet northeastward of the front light, and steer 112° true (**SE** by **E** ⅝ **E** mag.) for 1½ miles. Round the point on the southwestern bank in mid-channel, slightly favor, if either, the west bank until the reach eastward is open, and then pass in mid-channel northward of the old mill. Then favor the north bank, round the next point in mid-channel, and then favor the east bank to the draw of the highway bridge, which is close to the bulkhead at Columbia.

ALLIGATOR RIVER

is on the south side of Albemarle Sound, 11 miles westward of Croatan lighthouse. The entrance is full of shoals through which there is a channel, with a depth of 10 feet, marked by buoys and Alligator River light. For a distance of about 18 miles above its mouth the river has a south direction, is 2 to 3 miles wide, and has general depths of 8 to 11 feet. Above this the river has a length of about 24 miles, is narrow and crooked, and has a depth of 6 feet or more nearly to its head, its upper part, however, being too narrow to turn in. Near the head of navigation a canal for boats connects Alligator River with **Mattamuskeet Lake**, on the northern shore of which is the village of **Fairfield**. Logs are towed from the river in barges and rafts. On the eastern side just inside the mouth of the river is the entrance to **East Lake** and **South Lake**, which have general depths of 6 to 8 feet.

Little Alligator River empties into Alligator River from westward just inside the entrance. This river has a narrow, crooked channel with a depth of 6½ feet. **Fort Landing** is a post village on the west bank of Little Alligator River about 2 miles above the mouth. A draft of 5 feet can be taken about 4 miles above Fort Landing.

DIRECTIONS, ALLIGATOR RIVER.

From North River entrance buoy steer 203° true (**SSW** ½ **W** mag.) for 12 miles; or, from Pasquotank River, vessels of 7 feet or less draft with a smooth sea can pass ½ mile southward of Poquoson Point light, and then make good a 172° true (**S** ¼ **E** mag.) course for 13 miles with that light astern; either course will lead to the black buoy off the entrance of Alligator River.

Pass westward of the black buoy, steer about 181° true (**S** ½ **W** mag.), and pass about 300 yards eastward of Alligator River light and close eastward of the red buoy. Then steer 198° true (**SSW** mag.), passing about ½ mile off Sandy Point and westward of Sandy Point Shoal, and be guided by the chart.

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PAMLICO SOUND[1]

is described on page 152, and directions from Croatan Sound through Pamlico Sound to Neuse River are given on page 158.

LONG SHOAL RIVER

is a good anchorage for vessels of 8 feet or less draft. The entrance, which is about 1½ miles wide, lies on the north shore of Pamlico Sound, 7½ miles westward of Long Shoal lighthouse. Shoals with 1 to 2 feet over them lie on either side of the entrance and break the sea from southward; the channel has a depth of 9 feet to an anchorage above buoy No. 2, a depth of about 7 feet for 1½ miles, and 5 feet for a distance of 3 miles above buoy No. 2. The points of the shoals at the entrance are marked by buoys, so that a stranger should have no difficulty in entering in the daytime.

DIRECTIONS, LONG SHOAL RIVER.

FROM EASTWARD.—Give Long Shoal lighthouse a berth of 2¼ miles when southeastward of it, and when it bears 321° true (*NW* by *N* mag.) steer 282° true (**WNW ½ W** mag.) for 9 miles; or, vessels of 7 feet or less draft with a smooth sea can cross Long Shoal about ⅜ mile northwestward of the lighthouse, and from a position ¾ mile westward of the lighthouse steer 272° true (**W ⅝ N** mag.) for 7 miles with the lighthouse a little on the starboard quarter. Either course will lead to a position ⅜ mile southward of red buoy No. 2 on the eastern side of the entrance.

Then steer 344° true (**N** by **W** mag.) and pass 200 yards westward of buoy No. 2 and the same distance eastward of black buoy No. 3; the course continued will lead in the best water until above the shoal which makes off from the eastern shore northward of Pains Bay, and then keep near mid-river. Anchor on the sailing line, the depths shoaling from 11 feet abreast buoy No. 2 to about 8½ feet abreast buoy No. 3; vessels of a greater draft than 7 feet should not go above buoy No. 3. There is also good anchorage, exposed only to southeasterly winds, southward of buoy No. 2 and eastward of Pingleton Shoal.

FROM WESTWARD.—Pass ½ mile southeastward of Gull Shoal lighthouse and steer 25° true (**NNE ⅝ E** mag.) for 11¾ miles. Pass about ⅜ mile southeastward and eastward of the black buoy off the southerly end of Pingleton Shoal, and steer about 330° true (**NNW ¼ W** mag.) for 1⅜ miles to a position 200 yards westward of red buoy No. 2. Then steer 344° true (**N** by **W** mag.) as in the preceding paragraph.

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[1] Shown in part on charts **142, 143**, scale $\frac{1}{80,000}$; price of each $0.50; **144**[1], Pamlico River, and **144**[2], Neuse River, scale $\frac{1}{80,000}$; price of each $0.40.

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MIDDLETON ANCHORAGE

is a broad, open bight in the northern shore of Pamlico Sound, about 6 miles northward of Gull Shoal lighthouse. The anchorage has depths of 9 to 13 feet and is sheltered from eastward by **Gibbs Shoal**, which has from 1 to 4 feet over it. There is no shelter from southeasterly or southerly winds. The anchorage is large and easy of access, and is used to some extent by tows and other vessels. Two post villages, **Middleton** and **Englehard**, are situated a short distance inland from the anchorage.

DIRECTIONS, MIDDLETON ANCHORAGE.

FROM NORTHEASTWARD.—From a position 2⅜ miles southeastward of Long Shoal lighthouse steer 250° true (**WSW ⅝ W** mag.) for 13 miles; or, vessels of 7 feet draft with a smooth sea can cross Long Shoal about ⅜ mile northwestward of the lighthouse, and steer 238° true (**SW** by **W ⅝ W** mag.) for 12 miles. Either course will lead to a position ¼ mile southward of the black buoy on the southeasterly end of Gibbs Shoal. Then steer about 265° true (**W** mag.) for 1 mile, and then steer 310° true (**NW** mag.). Anchor about ¾ to 1 mile from shore in a depth of 11 to 12 feet. On all sides of the anchorage the shoals rise abruptly from depths of 9 to 11 feet.

FROM WESTWARD.—Passing about ½ mile eastward of Gull Shoal lighthouse, a 350° true (**N ½ W** mag.) course will lead to the anchorage.

AT NIGHT.—Pass well southward of Gibbs Shoal, and bring Gull Shoal light astern on a 354° true (**N ⅛ W** mag.) course, which will lead to the anchorage. The low, marshy shore, which extends long distances in front of the woods in places, does not generally show at night.

WYESOCKING BAY

makes into the north shore of Pamlico Sound northwestward of Gull Shoal lighthouse. It is a convenient anchorage for small craft of 6 feet or less draft when following the north shore of the sound. The entrance is obstructed by shoals, through which a buoyed channel leads into the bay northward of Gull Shoal. **Gull Rock**, which just shows above water, is a part of the shoals on the south side of the bay. Buoy No. 2 at the entrance lies 1¾ miles 319° true (**NW ¾ N** mag.) of Gull Shoal lighthouse. Anchorage in 10 to 11 feet can be had ½ to 1 mile northwestward of this buoy, on the west side of a shoal with about 4 feet over it which extends from the buoy to the shore.

To enter the bay pass about 200 yards southward of buoy No. 2 and steer 277° true (**W** by **N** mag.) for 1¼ miles to a position 100 yards southward of buoy No. 4. Then steer 305° true (**NW ½ W** mag.) and anchor in 7 to 8 feet, ⅜ to ½ mile off the west side of Long Point, with its southerly end bearing eastward of 108° true (**ESE** mag.). Above this anchorage the head of the bay has depths of 3 to 5 feet. At the head of the bay is a boat canal which communicates with Mattamuskeet Lake in the interior.

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JUNIPER BAY

makes into the north shore of Pamlico Sound 1½ miles eastward of Great Island. The entrance is about 1½ miles wide, but toward its head the bay narrows gradually and 3 miles above the entrance it is a narrow, crooked stream. Shoals make off from both shores, but the middle of the bay has a depth of 7 to 10 feet. At the head of the bay is a boat canal which communicates with **Mattamuskeet Lake**. There is considerable traffic to the farms on the bay in small craft of 5 feet or less draft, which use the inside route through Swan Quarter Narrows and Bay, and the canal to Deep Bay, in making the passage to and from Belhaven.

SWAN QUARTER BAY

makes into the north shore of Pamlico Sound westward of Great Island. At its entrance the bay is about 2 miles wide, but it contracts gradually toward its head, which is distant about 4½ miles above the entrance. A depth of 8 to 11 feet can be taken up to abreast the town of **Swan Quarter** through the channel, which is marked by range lights and buoys. The bay is full of oyster beds.

Great Island is low and grassy, and has a few houses at its northern end. **Swan Quarter Narrows**, the channel northward of the island, is good for vessels of 6 feet draft.

A canal 50 feet wide and 6 feet deep connects Swan Quarter Bay with Deep Bay. From Deep Bay the canal trends 49° true (**NE ¾ E** mag.) through the land to Swan Quarter Canal light, passing northward of it, and then trends 80° true (**E ½ N** mag.) for Swan Quarter range rear light to the channel of Swan Quarter Bay.

A canal 30 feet wide and 7 feet deep has been dredged ½ mile in an east-northeast direction from Swan Quarter Bay to Swan Quarter. The canal entrance is on the eastern side of the bay 1⅛ miles above Swan Quarter range rear light, and is marked by a stake with finger board; dredged material shows on the shore northward of the canal entrance.

DIRECTIONS, SWAN QUARTER BAY.

Local vessels up to 6 feet draft use the canal to Deep Bay in making the passage to or from points on Pamlico River and Belhaven, and use Swan Quarter Narrows when coming from or bound eastward. Strangers in vessels of deeper draft should enter by the deeper channels which lead between the extensive shoals southward of the bay. The following are directions from eastward:

Passing on either side of Bluff Shoal lighthouse at a distance of about ¼ mile, bring it astern on a 296° true (**NW** by **W ¼ W** mag.) course for 12 miles, passing 1 mile southwestward of Great Island light. Pass 1 mile southwestward and westward of Great Island, and steer about 336° true (**N** by **W ¾ W** mag.) on the line of the Swan Quarter range lights, passing close to the perpendicularly striped buoy in the entrance. Pass 200 yards eastward of the front light, steer 316° true (**NW ½ N** mag.), and pass about 300 yards south-southwestward and 150 yards westward and northwestward of the

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rear light. Then steer 35° true (**NE ½ N** mag.) for about ½ mile, and then follow the curve of the channel northward and pass about 100 yards eastward of buoy No. 3.

Anchorage in a depth of 11 feet can be had about ¼ mile eastward or northeastward of the front light; above the front light anchorage can be selected in the channel, which is good for a depth of 8 feet to buoy No. 3.

ROSE BAY

makes into the north shore of Pamlico Sound at the entrance of Pamlico River. The entrance is about 1¾ miles wide, but shoals making off from both sides leave the channel about ⅝ mile wide. The depth in the channel is 9 feet or more for a distance of 4 miles above the entrance; the principal shoals are marked by lights or buoys for this distance, above which the channel is narrow, crooked, and is good for a depth of 6 feet. Rose Bay, Deep Bay, and the canal to Swan Quarter Bay form an inside route that is generally used by local vessels up to 6 feet draft. The canal is described with Swan Quarter Bay.

DIRECTIONS, ROSE BAY.

Approaching from southward, bring Pamlico Point lighthouse astern on a 3° true (**N ⅝ E** mag.) course; approaching from westward give the shore a berth of ½ mile, and pass southward of the fish stakes on the shoals westward of the entrance. Pass ¼ mile westward and 250 yards northwestward of Judith Island light, steer 55° true (**NE by E ¼ E** mag.), and leave buoy No. 1 about 50 yards on the port hand. When past this buoy steer 27° true (**NNE ¾ E** mag.) and be guided by the buoys; anchor southward of buoy No. 3.

To DEEP BAY.—From buoy No. 1 steer 75° true (**E by N** mag.) for 1 mile, and then steer 122° true (**SE ¾ E** mag.) for 1¼ miles to a position 250 yards southward of Upper Island Point light. A 93° true (**E ⅝ S** mag.) course will then lead to the entrance of the canal which leads to Swan Quarter Bay.

MOUSE HARBOR, BIG PORPOISE BAY, AND MIDDLE BAY

are small, shallow bays on the western side of Pamlico Sound between Pamlico Point, at the entrance of Pamlico River, and Jones Bay. There are no aids to assist a stranger. They are frequented only by the boats of local fishermen.

JONES BAY

makes into the western shore of Pamlico Sound just northward of the entrances of Bay and Neuse Rivers. The bay is navigable for vessels of 7 feet draft for a distance of 5 miles above its mouth. The entrance is somewhat obstructed by shoals, through which a buoyed channel leads into the bay. On the north side, near the head of the bay, is the post village of **Hobucken**, the small-craft landings for which are in the cove ¾ mile above **Drum Creek**. When the water is high small boats can be taken through the old canal from **Ditch Creek** to **Bay River**.

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DIRECTIONS, JONES BAY.

FROM EASTWARD.—With a smooth sea a depth of 6 feet can be taken across Brant Island Shoal by passing about 250 yards southward of Brant Island Slue light on a southwesterly course. From a position ½ mile southwestward of this light steer 280° true (**WNW ¾ W** mag.) for 6 miles, and pass about 200 yards southward of buoys Nos. 2 and 4. Or, from a position ¼ mile southwestward of Brant Island Shoal light make good a 289° true (**WNW** mag.) course for 10¾ miles and pass ⅜ mile southward of buoy No. 2 and 200 yards southward of buoy No. 4.

Round buoy No. 4 at a distance of 200 yards, steer 33° true (**NE ¾ N** mag.), and pass 200 yards southward and eastward of buoy No. 1. Anchor ¼ to ½ mile northwestward of buoy No. 1, above which there are no aids. About 1 mile above buoy No. 1 a spit extends nearly halfway across the bay from the point on the southwest side of the entrance, and otherwise the channel is near the middle.

FROM WESTWARD.—Avoid the shoal, which extends over 1 mile southeastward from Bay Point; *Bay Point light* is on its southerly end, and the shoal extends a short distance eastward and nearly ¾ mile northeastward from the light. A 317° true (**NW ½ N** mag.) course, heading for the westerly point at the entrance of Jones Bay, will lead eastward of this shoal and up to buoy No. 4.

CEDAR ISLAND BAY

is a large, irregularly shaped body of water making into the western shore of Pamlico Sound southward of Neuse River entrance. The shores of the bay and its numerous branches are marshy, and it is of no importance except for its oyster beds. A depth of 9 feet can be taken into the principal arms of the bay through narrow and crooked channels. **Cedar Island Bay light** marks the northwest side of the channel at the entrance of the bay, and is located in a depth of 8 feet on the end of the shoal which extends south-southeastward from Swan Islands. From the south branch of the bay next eastward of Long Bay there is a boat passage into **Thoroughfare Bay** and thence into Core Sound.

ROYAL SHOAL.

In the bight formed by the hook of Royal Shoal vessels and tows sometimes anchor when the sea is too rough to make headway in the sound. The shoal, which has from 2 to 4 feet over it, and is bare in one place, breaks the sea so as to leave comparatively smooth water at the anchorage. The depth is 9 to 12 feet and the holding ground good.

DIRECTIONS TO THE ANCHORAGE BEHIND ROYAL SHOAL.

From the vicinity of Bluff Shoal lighthouse pass ½ mile northward and westward of Northwest Point Royal Shoal unused lighthouse and then steer about 198° true (**SSW** mag.).

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When Southwest Point Royal Shoal lighthouse bears 130° true (*SE* mag.), steer 142° true (**SE** by **S** mag.), and give the lighthouse a berth of about ¾ mile in rounding it until it bears westward of north.

Pass ½ mile eastward of the lighthouse on a north-northeasterly course; anchorage can be selected from ¾ to 1½ miles eastward or northeastward of the lighthouse in a depth of 10 to 14 feet.

PAMLICO RIVER

empties into the northwestern part of Pamlico Sound from northwestward. The town of **Washington**, on the east bank, 31 miles above the entrance, is considered the head of navigation for sailing vessels. A channel 200 feet wide and 10 feet deep leads to the town, which ships lumber in barges and small schooners, and supplies to the villages and settlements on the shores of Pamlico Sound. There are marine railways at Washington, and bituminous coal, gasoline, water, and ice can be obtained. The water in the river above Core Point is usually fresh enough to use in the boilers of steamers.

Below Washington several navigable rivers and creeks empty into Pamlico River, the most important of which are: Pungo River, Goose Creek, South Creek, Bath Creek, and Durham Creek.

Pungo River empties into Pamlico River from northward about 4 miles above the entrance. The channel is well marked by buoys and lights, and can be readily followed by a stranger for a distance of 15 miles. It then becomes narrow, but has a least channel depth of about 8 feet to **Leachville**, a village 18½ miles above its mouth; a drawbridge crosses the river at Leachville. A number of navigable creeks empty into Pungo River, from which logs are towed to Belhaven. The most important are Pungo Creek and Slade Creek.

Slade Creek empties into Pungo River from eastward 4 miles above Wade Point. A depth of 7 feet can be taken 2 miles above the entrance, and 4 feet 1½ miles farther.

Pungo Creek empties into Pungo River from westward 1¼ miles southwestward of Belhaven. A draw bridge crosses the narrow part of the creek 2¼ miles above the entrance. A depth of 7 feet can be taken just above the bridge, and 6 feet about 2 miles farther.

Pantego Creek empties into Pungo River from northward 8½ miles above Wade Point. On the eastern bank, just inside the entrance of the creek, is the town of **Belhaven**, which is the terminus of a railroad, and ships lumber and oysters by rail and lumber in barges. The channel of the creek has a depth of 9 feet to Belhaven and 8 feet can be taken 2¼ miles above its entrance. Gasoline, ice, water, and generally some coal can be had at Belhaven. There is a depth of 9 feet at the railroad wharf, and but little depth at the other wharves. A drawbridge crosses just above Belhaven.

Goose Creek empties into Pamlico River from southward about 6½ miles above its entrance. The entrance to the creek is obstructed by shoals, through which a narrow but deep channel, marked by buoys and Reeds Hammock light, leads into

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the creek, which has a channel depth of 11 feet for a distance of 3 miles. **Campbell Creek, Upper and Lower Spring Creek, Eastham Creek, Snode Creek,** and **Dixon Creek** are navigable tributaries of Goose Creek. Logs are towed from the creek. **Reeds Hammock light,** on the northwest side of the channel at the entrance, is located in a depth of about 6 feet near the end of the shoal which extends ½ mile east-southeastward from the western point at the entrance. The shore eastward and westward of the entrance should be given a berth of over ½ mile until the light bears between south and west-southwest.

South Creek empties into Pamlico River from southward about 9 miles above its entrance. The deeper entrance leads southward of Indian Island and the shoal connecting the island with Hickory Point and is buoyed. **Indian Island Slue** is a dredged cut, good for vessels of 5 feet draft, across the shoal between Indian Island and Hickory Point. The course through the cut is 178° true (S ⅛ W mag.), passing close to the two buoys which mark it, and about 100 yards eastward of Indian Island Slue light.

South Creek has a least channel depth of 8 feet for a distance of 4 miles above Hickory Point. **Aurora,** a village on the railroad 6½ miles above Hickory Point, is reached through a dredged channel 100 feet wide and 7 feet deep. The dredged channel follows the line of deepest water as shown on the chart, but local knowledge is needed to carry the best water above Point of Marsh. A drawbridge with a clear width of 20½ feet crosses the river just above Aurora, and a railroad bridge, which is practically the head of navigation, crosses at **Royal,** 1¼ miles above Aurora.

Bond Creek is on the south side of South Creek southward of Hickory Point. It has a depth of 7 feet to the wharf at the sawmill and post office of **South Creek.** To enter, pass northward and ¼ mile westward of buoy No. 1; then steer 207° true (SSW ¾ W mag.) for the entrance and be guided by the buoys to the wharf.

Durham Creek empties into Pamlico River from southward about 17½ miles above its mouth and 2½ miles westward of Rumley Marsh light. The creek is navigable for a draft of 5 feet nearly to **Bonners Bridge,** a distance of 4 miles above its mouth. A sawmill and wharf, with 6 feet at its end, are located on the west side ½ mile above the entrance. There are no aids except a private beacon, which marks the west side of the narrowest part of the channel at the entrance.

Bath Creek empties into Pamlico River from northward, 3½ miles northwestward of Rumley Marsh light. A draft of 6½ feet can be taken to the village of **Bath,** about 1¾ miles above its mouth, and a draft of 5 feet can be taken about 4 miles above the entrance. A drawbridge crosses the creek at the upper end of Bath. The most difficult place in the channel to Bath is in the narrowest part of the entrance, where a shoal which shows by the grass on it extends halfway across from the west side, and rises abruptly from the channel.

Blount Creek empties into Pamlico River from southward, 2½ miles westward of Mauls Point light. A draft of 6 feet can be taken into the creek, and 4 feet can be taken about 4 miles above the drawbridge which crosses about ⅜ mile above the entrance.

Tar River, which is the continuation of Pamlico River above Washington, is being improved to obtain a channel 4 feet deep to **Greenville,** 19 miles; 20 inches deep

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to **Tarboro**, 43 miles; and to clear the river of snags to **Little Falls**, 77 miles. The head of navigation is **Dunbar Bridge**, 94 miles above Washington. Above Greenville the river is navigable for light-draft steamers only during freshet stages of variable duration, extending over six or eight months of the year. **Fishing Creek** is a branch of Tar River, 49 miles above Washington; it has been cleared of snags for 15 miles to **Beech Swamp**, to which point about 2 feet can be carried for about three months each year.

Tides.—There are practically no tides, the variations in water level being due principally to winds. Easterly winds cause high water and westerly winds low water, the maximum variation with heavy gales amounting to about 2 feet above or below the normal in the lower part of the river and 3 or 4 feet at Washington. Freshets of 10 to 20 feet occur in the upper reaches of the river above Washington, but have little effect at and below the town.

DIRECTIONS, PAMLICO RIVER TO WASHINGTON.

Directions from Croatan Sound through Pamlico Sound are given on page 158.

From a position ¼ mile southward of Bluff Shoal lighthouse steer 275° true (**W ¾ N** mag.) for 11¼ miles, passing ¾ mile southward of the horizontally striped buoy at the southeasterly end of Lower Middle and 1 mile southward of the horizontally striped buoy at the southwesterly end of Inner Middle. When the latter buoy is abeam, steer 310° true (**NW ⅛ W** mag.) for 9½ miles, passing ½ mile northeastward of Pamlico Point lighthouse.

When Pamlico Point lighthouse bears 176° true (*S* mag.), steer 294° true (**NW** by **W ½ W** mag.) for 6¼ miles to a position ¾ mile south-southwestward of Pungo River light. Then steer 284° true (**WNW ⅜ W** mag.) for 10 miles to a position 300 yards southward of Rumley Marsh light. Then steer 291° true (**NW** by **W ¾ W** mag.) for 4 miles to a position ¼ mile northward of the black buoy off Core Point. Then steer 286° true (**WNW ¼ W** mag.) for nearly 4 miles to a position 200 yards northward of Mauls Point light.

From a position 200 yards northward of Mauls Point light steer 277° true (**W** by **N** mag.) for 1⅝ miles until abreast buoy No. 6, and then steer 302° true (**NW ¾ W** mag.) for 1¼ miles to a position 100 yards westward of buoy No. 8. Then steer 315° true (**NW ⅜ N** mag.), pass a little over ¼ mile off Hills Point, and continue the course to a position 100 feet southwestward of Hills Creek light (red structure), at the entrance to the dredged cuts.

Then steer 302° true (**NW ⅞ W** mag.) to a position 100 feet southwestward of Fork Point light (red structure). Then steer 320° true (**NW ¾ N** mag.) for the high black water tank in Washington showing midway between *Mc Williams Point Shoal light* (red structure) and *Rodman Point Shoal light* (black structure), and pass these lights at a distance of 100 feet. From a position 100 feet

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northeastward of Rodman Point Shoal light steer 307° true (**NW ⅜ W** mag.) and pass 100 feet southwestward of *Windmill Point Shoal light* (red structure). Then steer 325° true (**NNW ¾ W** mag.) for the draw, pass preferably through the eastern opening, and continue the course to the wharves, which should be followed at a distance of about 150 feet. Vessels should go to the wharves.

DIRECTIONS, PUNGO RIVER TO BELHAVEN.

Having followed the directions for Pamlico River above, pass ½ mile northeastward of Pamlico Point lighthouse and steer 310° true (**NW ⅛ W** mag.) for 7 miles to the middle of the entrance of Pungo River; or, coming down Pamlico River, pass southward of the horizontally striped buoy off Wade Point, and about ½ mile southward and eastward of Pungo River light (on southeast end of shoal off Wade Point).

Then steer 344° true (**N** by **W** ⅛ **W** mag.) for Woodstock Point light and pass ¼ to ⅜ mile westward of buoy No. 2 off Currituck Point and 200 yards eastward of buoy No. 1 off Grassy Point. Then steer 336° true (**N** by **W ¾ W** mag.) and pass 300 yards westward of buoy No. 4. Then steer 349° true (**N ⅝ W** mag.) to a position 200 yards eastward of Woodstock Point light. Then steer 328° true (**NNW ½ W** mag.), pass 250 yards westward of buoy No. 8, and to a position 100 yards eastward of Pantego Creek light. Then steer 319° true (**NW ¾ N** mag.) for the outer end of the upper wharf house of Belhaven; anchor in mid-channel below the buoys, or continue past them and anchor in mid-channel just above the railroad wharf.

BAY RIVER

empties into the western part of Pamlico Sound from westward, the entrance being just north of the mouth of Neuse River and about 5 miles north-northeastward of Neuse River lighthouse. The entrance is marked by Maw Point Shoal and Bay Point lights. The channel for a distance of 11 miles above the entrance is marked by buoys, has a depth of 9 feet or more, and can be readily followed. Above this point the channel is a dredged cut 150 feet wide and 10 feet deep to a point ⅝ mile below Stonewall, and thence 100 feet wide and 10 feet deep to Bayboro, which is practically the head of navigation; the dredged cuts are marked by range beacons, but some local knowledge is needed to follow them. **Vandemere** is a village and railroad terminal, 8 miles above the entrance of Bay River; there is a depth of 8 feet at the end of the railroad wharf. **Stonewall** and **Bayboro** are villages, with railroad communication, on the river 13 and 14 miles above the entrance; lumber is shipped from the sawmills at these places, and there is a fertilizer factory at Bayboro.

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DIRECTIONS, BAY RIVER.

FROM EASTWARD.—With a smooth sea a depth of 6 feet can be taken across Brant Island Shoal by passing about 250 yards southward of Brant Island Slue light on a southwesterly course. From a position ½ mile southwestward of this light steer 266° true (**W** mag.) for 6 miles; or, from a position ¼ mile southwestward of Brant Island Shoal light, make good a 281° true (**WNW** ⅝ **W** mag.) course for 10¾ miles. Either course should lead to a position ¼ mile southward of Bay Point light. Then steer 289° true (**WNW** mag.) for 2½ miles, and pass about 100 yards northward of buoy No. 5.

From a position ¼ mile northwestward of buoy No. 5, steer 266° true (**W** mag.) for 1 mile, giving the southern shore a berth of about ½ mile, and then keep near the middle of the river, giving the buoys a berth of over 100 yards until westward of buoy No. 6. Then give the northern shore of *Mason Bay* a berth of ¼ mile, and follow the buoys at a distance of 75 to 100 yards. Anchorage can be selected in the channel of the river up to the entrance of the dredged cuts about 150 yards northwestward of buoy No. 11, but above this point there is not room for anchorage except for small craft.

FROM WESTWARD.—Pass ½ mile eastward and northeastward of Maw Point Shoal light, and steer 322° true (**NW** by **N** mag.) for 1½ miles to a position about 300 yards northeastward of buoy No. 3. Then steer 304° true (**NW** ⅝ **W** mag.) for 1¾ miles and pass about 100 yards northeastward of buoy No. 5. Then follow the directions in the preceding paragraph.

NEUSE RIVER[1]

empties into the western end of Pamlico Sound and is one of the important rivers of North Carolina. For a distance of 25 miles above its mouth the river has a width varying from 5 to 1¾ miles and a channel depth of over 13 feet; above this the channel has a depth of 11 feet to Newbern. From the entrance of the river to Newbern the channel is marked by lights and buoys.

Newbern is a city on the west bank of Neuse River, 34 miles above the entrance; it ships lumber in barges and fish and farm produce by railroad. There is a marine railway 110 feet long, with a capacity of 500 tons, and anthracite and bituminous coal, gasoline, water, and ice can be obtained. There is a relief station of the United States Public Health Service, and storm warnings are displayed. The river water is slightly brackish at Newbern except during freshets. The quarantine officer is at Newbern; the quarantine station and anchorage is about 2 miles below.

Turnagain Bay is on the south side of Neuse River, south-southeastward of Neuse River lighthouse. It has a depth of 9 feet or more in a narrow channel for a dis-

[1] Shown on chart 144[2], scale $\frac{1}{80,000}$, price $0.40; the port of Newbern is shown on chart 410, scale $\frac{1}{40,000}$, price $0.20.

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tance of 3 miles above the entrance; the entrance is marked by private buoys. The old canal to Long Bay is closed.

Broad Creek entrance is on the north side of Neuse River, 1¾ miles westward of Neuse River lighthouse. Lower Broad Creek light marks the west side of the channel at the entrance. **Pamlico** is a post office and sawmill on the south side of Broad Creek, 2½ miles above the entrance. Vessels load to a depth of 6 feet on the eastern side of the slab wharf at the sawmill and anchor off the mouth of **Tar Creek** to load to 8 feet. To enter Broad Creek, pass 100 yards eastward and northward of Lower Broad Creek light, and steer 266° true (**W** mag.) until past the point of the shoal, which shows by discolored water, on the starboard hand; then steer northwestward, slightly favoring the western bank until abreast the turning point on that side, and then keep in mid-creek.

South River is on the south side of Neuse River, 6 miles south-southwestward of Neuse River lighthouse. The channel at the entrance is marked by buoys, and on its west side by South River light. The channel has a depth of 10 feet for 5½ miles, and 8 feet for 7 miles, above the entrance. To enter South River, steer 153° true (**SSE** mag.) for South River light in range with the southernmost point that shows on the east side of the creek until up with buoy No. 1, and then change the course so as to pass 100 yards eastward of the light. When past the light, change the course gradually to 193° true (**S** by **W** ½ **W** mag.), giving the edge of the bank, which shows by discolored water and is steep-to, on the west side of the channel a berth of 75 to 100 yards, and pass 100 yards westward of buoy No. 3. Then keep in mid-river.

Oriental is a post village and railroad terminus on the eastern side of **Smith Creek**, north side of Neuse River, 8½ miles westward of Neuse River lighthouse. Supplies, gasoline, and ice can be obtained here. There is a depth of 10 feet in the channel and about 9 feet at the principal wharves. A bulkhead for dredged material extends southwestward to the channel from the eastern point at the entrance, and the cove northward of the bulkhead has been dredged to a depth of 10 feet. The best anchorage is in this cove, but vessels of 7 feet draft can anchor westward of the sawmill wharf toward the entrance of **Kershaw Creek**.

A depth of about 9 feet can be taken into Smith Creek to the wharves of Oriental by steering about 308° true (**NW** ¼ **W** mag.) for the old mill on the west side of the creek just open westward of Chadwicks Point Shoal light. Pass 100 feet westward of the light and steer 339° true (**N** by **W** ½ **W** mag.) for the end of the sawmill wharf, passing 125 feet off the end of the bulkhead; and continue the course to the sawmill wharf to avoid a shoal, with little water over it, which extends over halfway across from the old mill on the western side, the end of the shoal lying 100 yards southwestward of the southeast end of the sawmill wharf.

Adams Creek is a part of the inland waterway between Pamlico Sound and Beaufort Harbor, and is described on pages 152 and 159.

Clubfoot Creek empties into Neuse River from southward about 14 miles above Neuse River lighthouse. Clubfoot Creek light is located in a depth of 6 feet, on the eastern side of the entrance. The channel in the entrance, southward of the light, is narrow, with shoals which rise abruptly on both sides. There is a depth

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of 9 feet through the entrance, 7 feet for 2½ miles, and 5 feet for 3½ miles above Clubfoot Creek light. **North Harlowe** is a post office on the west side of the creek, and there are two sawmills on the east side. From the creek there is a passage, good for a depth of 3½ feet at high water, through the **Clubfoot Canal** and **Harlowe Creek** to Beaufort Harbor. To enter Clubfoot Creek, pass 200 yards westward and southwestward of Clubfoot Creek light, steer about 143° true (**SE** by **S** mag.), slightly favor the east bank until approaching the old mill wharves on the west side northward of **Mitchell Creek**, and then keep in mid-creek.

Hancock Creek is off the south side of Neuse River, nearly 3 miles west-southwestward of Wilkinson Point Shoal light. A depth of about 4 feet can be taken into the creek.

Slocum Creek is on the south side of Neuse River, 4½ miles westward of Wilkinson Point Shoal light. A draft of 6½ feet is loaded at the old sawmill just inside the entrance. There is a depth of 4½ feet in the channel of the creek to the forks, a distance of 4½ miles, and up the west branch for 2½ miles farther to **Harelock**, a post office on the railroad. There is a buoy at the entrance, and otherwise the chart is the guide.

Beard Creek is on the northeast side of Neuse River, 4 miles northwestward of Wilkinson Point Shoal light. A depth of 5 feet can be taken about 4½ miles up the creek to the county bridge.

Goose Creek is on the northeast side of Neuse River, 6 miles below Newbern. A depth of 7 feet can be taken about 4½ miles up the creek.

Upper Broad Creek is on the northeast side of Neuse River, 5 miles below Newbern. A depth of 7½ feet can be taken about 10 miles up the creek to Tuly Landing, and 5 feet about 1 mile farther to the head of navigation at the county bridge.

Neuse River above Newbern has a low-water depth of 4 feet to **Village Creek**, 22 miles; 2½ feet to the mouth of **Contentnia Creek**, 28 miles; and 1 foot to **Kinston**, 44 miles, above which the river is navigable only during freshet stages of more than 2 or 3 feet. Kinston is reached by light-draft steamers only during freshet stages of variable duration, extending over 6 or 8 months of the year. **Waynesboro Landing** (**Goldsboro**), 85 miles above Newbern, is practically the head of navigation, the river being occasionally cleared of obstructions to that point; boats have gone up as far as **Smithfield**, 130 miles above Newbern.

Swift Creek, a branch of Neuse River 7 miles above Newbern, has been cleared of obstructions for a distance of 12 miles to the village of **Vanceboro**, the head of navigation, and has an average width of 100 feet and a depth of 7 feet or more.

Contentnia Creek, a branch of Neuse River 28 miles above Newbern, is navigable for light-draft steamers during freshet stages for 28 miles to **Snow Hill**, which is practically the head of navigation. Boats occasionally go up as far as **Fools Bridge**, 9 miles above Snow Hill, and have gone up as far as **Speights Bridge** (closed), 16 miles above Snow Hill.

Trent River empties into the Neuse at the southern end of the city of Newbern. Its least channel depth for a distance of 16 miles to **Polloksville** is 8 feet; to **Quaker Bridge**, 24 miles above Newbern, 6 feet; and to **Trenton**, 33 miles above Newbern, 4 feet. At Newbern the river is crossed by two bridges with draws about 35 feet wide.

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Tides.—There are practically no tides, the variations in water level being due principally to winds. Easterly winds cause high water, and westerly winds low water, the maximum variations with heavy gales amounting to about 2 feet above or below the normal in the lower part of the river and about 3 or 4 feet at Newbern. Freshets of 10 to 20 feet occur in the upper reaches of the river above Newbern, but have little effect at and below the town.

DIRECTIONS, NEUSE RIVER.

Directions through Pamlico Sound and Neuse River to Garbacon Shoal light are given on page 158. The following directions are good for a depth of 8 feet to Newbern:

From a position ¼ mile northward of Garbacon Shoal light steer 238° true (**SW** by**W** ½ **W** mag.) for 5 miles, giving the north shore a berth of about 1 mile, and then steer 255° true (**W** by **S** mag.) for 2½ miles to a position ¼ mile southward of Wilkinson Point Shoal light. Then steer 288° true (**WNW** ⅛ **W** mag.) for 8 miles to Otter Creek light.

Pass 100 yards westward of Otter Creek light and steer 335° true (**N** by **W** ⅞ **W** mag.) for 3 miles, passing ¼ mile westward of buoy No. 8, and to a position 200 yards eastward of Johnson Point light (black structure). Then steer 330° true (**NNW** ⅜ **W** mag.) for 2⅜ miles, heading for Fort Point Channel light (red structure). Pass 150 yards southwestward of this light and steer 277° true (**W** by **N** mag.) for Lower Green Spring light to a position 100 feet southwestward of buoy No.12. Then steer 304° true (**NW** ⅝ **W** mag.) for an iron stack at the fertilizer factory in range with a brick stack in the western part of Newbern until up with Upper Green Spring light (red structure). Pass 50 yards westward of this light and steer 332° true (**NNW** ⅛ **W** mag.) for a square brick stack at the southeasterly end of Newbern. A buoyed channel 300 feet wide leads northward in Neuse River close to the wharves on the eastern side of the city until above the second drawbridge. *Anchorage* can be had on the south side of the city, in the mouth of Trent River, below the first bridge, in 10 to 18 feet.

CORE SOUND

is a narrow and shoal body of water extending along and just inside the beach for a length of 27 miles, from the southwest end of Pamlico Sound to a point inside Cape Lookout. At its western end, Core Sound joins a similar body of water, known as Back Sound, and a narrower body, north of Harkers Island, known as The Straits, both of which connect with Beaufort Harbor and Inlet. Core Sound varies in width from 2 to 3 miles and has a general southwesterly trend. It is nearly filled with shoal banks, over which the depth ranges from 2 to 4 feet; but a channel, from 7 to 10 feet deep, winds through the sound and is continuous, except at three places, where bars of 5 feet depth must be crossed. These bars are situated as follows: Harbor Island

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Bar, at the entrance from Pamplico Sound; Piney Point Bar, off Piney Point, about 15 miles down the sound; and Yellow Shoal, off Bells Point, 6 miles farther southwestward.

Wainwright Slue is a small anchorage at the entrance to Core Sound about 1 mile eastward of Harbor Island Bar lighthouse; it is marked by two buoys, and shelter from the sea is afforded by the surrounding shoals, which have from 2 to 3 feet over them. The depths range from 9 to 19 feet, and vessels anchor in the entrance, or farther in so as to get the best protection from the sea.

Thoroughfare Bay, on the north side of Core Sound, is connected with Cedar Island Bay by a narrow passage, and this forms a boat route into Pamlico Sound near the mouth of Neuse River.

Back Sound trends about westward from Core Sound for 6 miles to Beaufort Harbor and varies in width from over 2 miles to ½ mile; passage to Core Sound, except for very light draft boats, is blocked by a shoal at the junction of the two sounds, over which there is but 3½ feet of water.

The Straits parallel Back Sound north of Harkers Island and Middle Marshes, and offer a through deep passage from Core Sound to the western end of Back Sound. The width is from ⅜ to ¾ mile, but the clear channel is only 100 yards at places.

Tidal currents of 1 to 2 knots may be found in the lower part of Core Sound.

DIRECTIONS, CORE SOUND.

The depths in Core Sound are affected by the winds, northerly and northeasterly winds causing high water, and westerly and southwesterly winds low water.

The channel through Core Sound and The Straits is marked on each side by lights on red or black structures, and by rough piles and saplings with red or black boards pointing to the best water, and in the fairway by white and black vertically striped beacons. The red structures and stakes are left to starboard and the black to port going westward, and the black and white beacons are passed close to on either side. The aids must be relied upon to keep in the best water, and the following general directions are intended only to assist in finding them.

The channel over *Harbor Island Bar* has a depth of 5 feet, and is partially staked by the light keeper; these stakes are destroyed during gales, but are replaced. In January, 1913, the entrance was northeastward of the light, and curved westward on the bar and then southward, passing westward of the light. A depth of 4½ feet was found in the old straight channel across the bar on a course about south, passing westward of the light; a stranger drawing over 4 feet should employ a local fisherman for a pilot, or sound out the channel.

From Harbor Island Bar lighthouse the channel trends about 186° true (**S ⅞ W** mag.) for 3⅝ miles to East Drum Shoal light (black structure); thence about 251° true (**WSW ⅝ W** mag.) for 1½ miles

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to West Drum Shoal light (black structure); thence about 213° 30′ true (**SW** ⅝ **S** mag.) for nearly 1½ miles to Lewis Creek light (black structure); thence 227° true (**SW** ½ **W** mag.) for 3½ miles to White Point light (red structure); thence 222° true (**SW** ⅛ **W** mag.) for 2¾ miles, passing Steep Point light (red structure) and to Mill Point light (black structure); thence 271° true (**W** ½ **N** mag.) for ½ mile to Nelson Bay light (black structure); and thence 222° true (**SW** ⅛ **W** mag.) for 2 miles to Piney Point light (black structure).

From Piney Point light the channel trends west-southwestward for ⅝ mile to Butts Point light (black structure); and thence west-northwestward and then southwestward over *Piney Point Bar*, where it is well marked by side stakes and by Bretts Bay light (red structure) and Kings Point light (black structure).

From Kings Point light the channel trends 204° 30′ true (**SSW** ½ **W** mag.) for 3¾ miles, passing Davis Shore light (red structure) and to Davis Island light (black structure); thence 246° true (**WSW** ¼ **W** mag.) for 1½ miles to Jarretts Bay light (black structure); and thence 155° 30′ true (**S** by **E** ⅞ **E** mag.) for 1⅜ miles to Bells Point light (black structure).

From Bells Point light the channel curves gradually westward, and trends westward through The Straits; the distance to The Straits is 2 miles, and thence through The Straits to the west end of Harkers Island is 3½ miles. The channel is narrow and well marked by lights and stakes on each side. From North River light (red structure abreast the west end of Harkers Island) the channel crosses in a southwest direction to Shepherd Shoal light (red structure); thence westward to Middle Marshes light (black structure); and thence about 243° true (**WSW** mag.) to Shackleford Point. Thence the channel is marked by buoys and trends west-northwestward to the main channel of Beaufort Harbor.

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INSIDE ROUTE, NORFOLK TO KEY WEST.

TABLE OF DISTANCES AND DRAFTS.

From—	To—	Distance in nautical miles.	Maximum draft in feet.
New York, N. Y.....	South Amboy, N. J.....	19	21
	New Brunswick, N. J.....	29	10
	Bordentown, N. J.....	68	7
	Philadelphia, Pa.....	93	7
Philadelphia, Pa.....	Delaware City, Del.....	35	9
	Chesapeake City, Md.....	47	9
	Baltimore entrance, Md.....	84	9
	Baltimore, Md.....	94	9
Baltimore entrance, Md..	Annapolis entrance, Md.....	15	30
	Patuxent River, Md.....	55	30
	Cape Lookout, Potomac River.....	72	35
	Old Point Comfort, Va.....	138	35
	Norfolk, Va.....	148	35
Norfolk, Va.....	Elizabeth City, N. C.....	44	9
	*Roanoke Marshes light, N. C.....	84	9
	*Adams Creek, N. C.....	164	9
	*Beaufort or Morehead City, N. C..	181	9
	*Beaufort entrance, N. C.....	185	9
Morehead City, N. C....	Bogue Inlet, N. C.....	23	4
	Bear Inlet, N. C.....	27	4
	New River Inlet, N. C.....	38	3
Beaufort entrance, N. C. (outside).	Frying Pan Shoals, N. C.....	89	15
	Southport, N. C.....	117	15
	Winyah Bay, S. C.....	162	15
	Georgetown, S. C.....	174	15
Winyah Bay, S. C.....	Charleston, S. C.....	70	6
Charleston, S. C.....	Beaufort, S. C.....	75	9
	Savannah, Ga.....	118	9
	Brunswick, Ga.....	206	9
	Fernandina, Fla.....	231	9
	St. Johns River, Fla.....	256	5
	Jacksonville, Fla.....	274	5
St. Johns River, Fla.....	St. Augustine, Fla.....	34	5
	Daytona, Fla.....	80	4
	Mosquito Inlet, Fla.....	91	4
	New Smyrna, Fla.....	94	4
	Titusville, Fla.....	125	4
	Cocoa, Fla.....	141	4
	Eau Gallie, Fla.....	156	4
	Fort Pierce, Fla.....	201	4
	St. Lucie Inlet, Fla.....	220	4
	Jupiter Inlet, Fla.....	235	4
	West Palm Beach, Fla.....	250	4
	New River Inlet, Fla.....	287	4
	Fort Lauderdale, Fla.....	289	4
	Miami, Fla.....	310	4
Miami, Fla.....	Bahia Honda Harbor, Fla. (northward of keys).	100	5
	Key West (through Hawk Channel from Bahia Honda).....	133	5
	Key West (through Gulf of Mexico from Bahia Honda).....	149	5

* Distances are via Dismal Swamp Canal route. For distances via Albemarle and Chesapeake Canal route subtract 3 miles.

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NORFOLK TO BEAUFORT, N. C.

From the Southern Branch of Elizabeth River to Albemarle Sound there are two routes that are used: One, through the Albemarle and Chesapeake Canal, North Landing River, Coanjock Canal, and North River, is under improvement by the Government and is free of tolls; and the other through Deep Creek, Dismal Swamp Canal, and Pasquotank River. Thence the route leads through Albemarle, Croatan, and Pamlico Sounds, Neuse River, Adams Creek, canal to Core Creek, and Beaufort Harbor. The passage is good for a draft of 9 feet by the way of Dismal Swamp Canal, and 8 feet by the way of Albemarle and Chesapeake Canal; improvements are authorized to secure a depth of 12 feet from Norfolk to Beaufort, N. C., by way o the Albemarle and Chesapeake Canal route. The distance from Norfolk to Beaufort Harbor entrance, N. C., is about 185 nautical miles by the way of Dismal Swamp Canal and 182 miles by the way of Albemarle and Chesapeake Canal.

Coal, gasoline, provisions, and other supplies can be obtained at Norfolk, Elizabeth City, Morehead City, and Beaufort, N. C.

Fresh water can be obtained at Norfolk, Elizabeth City, Morehead City, and Beaufort, and water suitable for boilers can be taken from the canals, the upper end of the narrow part of North Landing River, and Pasquotank River at and above Elizabeth City.

Repairs.—There are marine railways and facilities for repairing vessels at Norfolk and Elizabeth City, and for small craft at Morehead City and Beaufort, N. C

A **pilot** can be obtained on inquiring at Norfolk, Elizabeth City, Morehead, or Beaufort, N. C.

Tides are experienced only in the Southern Branch of Elizabeth River and Beaufort Harbor. In Albemarle and Pamlico Sounds and tributaries winds have considerable effect in raising or lowering the water, as mentioned in the following description.

ALBEMARLE AND CHESAPEAKE CANAL ROUTE.

Southern Branch of Elizabeth River forms the northern approach to the two canals which afford passages from Chesapeake Bay to the inland waters of North Carolina. This branch is of considerable commercial importance; there are several large lumber mills at which vessels load, and the commerce using the canals also passes through the branch. Between the Navy Yard at Portsmouth and Deep Creek the branch is crossed by three railroad drawbridges; two drawbridges cross the branch above Deep Creek.

Between the first and second bridges the channel has been dredged 300 feet wide and 25 feet deep, and between the second and third bridges 200 feet wide and 22 feet deep; above this and to the lock of the Albemarle and Chesapeake Canal the depth in the channel is about 9 feet. The channel for its whole length of 10½ miles is marked by buoys, and is not difficult to navigate as far as the entrance to Deep Creek. Above this to the lock of the Albemarle and Chesapeake Canal some local knowledge is needed to follow the channel.

The **Albemarle and Chesapeake Canal** route has been purchased by the Government and is free of tolls. This canal connects the Southern Branch of Elizabeth River with

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North Landing River, and has one lock at its northern end, about 10½ miles from Norfolk. This canal is 7¼ miles long and affords a passage for vessels 200 feet long, 39 feet beam, and 8 feet draft; it is crossed by two drawbridges. The depth of water in the canal is lowered by northerly winds and raised by southerly winds; severe storms may cause a difference of 2 feet or more below or above the normal.

The following are extracts from the regulations prescribed by the Secretary of War for the use of the Government canals and waterways between Norfolk and Beaufort, N. C., copies of which are posted along the route:

The signal for the lock is two long and two short blasts of the whistle, and for a bridge three long blasts. Boats approaching other boats shall give the passing signals prescribed in the Pilot Rules of the Steamboat Inspection Service. The draft that can enter the lock is shown by gauges. Boats will not be permitted to enter or leave the lock until the gates are fully in the recesses, and the lock keeper has ordered the boat to start. Steamers must be securely moored in the lock. Vessels must have their sides free from projections that might injure the walls, and must be provided with suitable fenders. No vessel shall obstruct the canal or approaches, or tie up for some hours or days in the narrow parts of the waterway without proper authority. The limit of speed in the canals is 5 statute miles per hour, and vessels approaching others must slacken speed. Rafts and tows must give to packets the side demanded by a proper signal. No refuse of any kind shall be placed in the canals or natural waterways, or on the banks; nor shall anyone clean flues in the locks. Trespass on or injury to canal property is forbidden.

North Landing River is 10½ miles long in its narrow part from the Albemarle and Chesapeake Canal to light No. 1, 100 to 300 feet wide, and has a depth of 9 feet or more. Southward of light No. 1 the channel is a dredged cut, 80 feet wide and 9 feet deep, through the broad part of North Landing River, Coanjock Bay, and thence in a canal to light No. 9 at the head of North River, a total distance of 19 miles.

Tides.—There are no tides in these waters, and the water level depends on the force and direction of the wind. Northerly winds lower the water and southerly winds raise it, there being at times a difference of 2 feet or more below or above the normal with strong, long-continued winds from one direction.

Munden is a post village and railroad terminal on the east side of North Landing River, a little over 1 mile southward of light No. 2. From the dredged cut off the wharf a depth of 7½ feet can be carried to the wharf, which has a depth of 8 feet at its end and on the north side.

Currituck is a small village on the west side opposite the mouth of North Landing River.

There is a station of the Lighthouse Service at the entrance of Coanjock Bay, on the west side of the channel just southward of light No. 7.

Coanjock is a post village on the canal between Coanjock Bay and North River.

Currituck Sound is a narrow and shoal body of water extending from Albemarle Sound in a north-northwesterly direction for 25 miles, and is separated from the ocean by a narrow strip of sand beach. The lower part of the sound is navigable for boats of 4 to 5 feet draft for a distance of 11 miles above the entrance from Albemarle Sound, but the navigation is difficult on account of extensive shoals.

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Back Bay and its connection with Currituck Sound extends a little over 10 miles northward from the northeastern end of the sound. The bay is shoal and navigable only for boats. Northward of Back Bay is a shallow body of water known as North Bay.

North River is 4½ miles long in its narrower part from light No. 9 to light No. 10, and thence for 7 miles to the entrance at North River lighthouse the river is wide and nearly straight. The river has a depth of 9 feet or more and its navigation is not difficult with the aid of the chart. A dredged cut 80 feet wide and 9 feet deep leads across the bar at the entrance of the river, and is marked by range lights and buoys.

DISMAL SWAMP CANAL ROUTE.

Deep Creek, which empties into the Southern Branch about 6 miles above Norfolk, is 2½ miles long to the entrance of the Dismal Swamp Canal; the creek has been improved by dredging a channel 100 feet wide and 10 feet deep from the Southern Branch to the canal. On the south side at the entrance of the creek there is a lighted sign board directing the way to the Dismal Swamp Canal.

Dismal Swamp Canal (Lake Drummond Canal & Water Co.'s Canal) connects Deep Creek with the Pasquotank River; the northern lock of the canal is about 8½ miles above Norfolk. This canal is about 19 miles long, 60 feet wide, and 9 to 10 feet deep, with turnouts at distances of about 3 miles where vessels may pass each other; the two locks are 250 feet long and 39 feet wide. Two drawbridges cross the canal; the settlements on its banks are the post villages of **Deep Creek** at the north entrance, **Wallaceton**, about 8 miles from the north entrance, and **South Mills**, about ⅛ mile inside the southern lock of the canal. The navigation of Deep Creek, and a part of Pasquotank River requires local knowledge to carry the best water. Toll is collected at the northern lock.

The following are extracts from the rules and regulations of the Lake Drummond Canal & Water Co., a copy of which will be furnished by the company on application:

Vessels arriving at the locks are required to come to and make fast 150 feet from the gates. Sailing vessels will not be permitted to sail in the canal. Where they have centerboards they must be entirely hoisted up when under way. No vessel of any description shall pass through the canal at a rate exceeding 5 statute miles an hour, except by permission of the superintendent in writing. Vessels passing through the canal shall keep to the right. When a vessel is overtaken by another going in the same direction, the slower shall give the inner track to the faster, unless within 300 yards of a lock or bridge. Steamers shall pass each other on the right and shall give signals as required by United States laws, and shall come to a minimum speed in passing vessels. Vessels approaching a lock, bridge, or vessel shall give notice by giving three blasts of whistle, or by sounding a horn, or ringing a bell at a distance of at least 400 yards. Vessels navigating the canal at night shall carry regulation lights as prescribed by United States laws; and while lying in the canal, vessels and rafts must show lights head and stern.

Turners Cut is a canal 3¾ miles long, 100 feet wide, and 10 feet deep, which extends in nearly a straight line from the Dismal Swamp Canal to Pasquotank River.

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Pasquotank River has a length of 12½ miles from the southerly end of Turners Cut to Elizabeth City, and thence 15 miles to Wade Point lighthouse, at the entrance from Albemarle Sound. The upper part of the river has been improved by dredging where necessary, and is good for a depth of 10 feet from Turners Cut to Albemarle Sound. Local knowledge is required in places to keep in the best water.

Elizabeth City, on the west bank of Elizabeth River 15 miles above Wade Point lighthouse, is one of the important towns on the inland waters of North Carolina. It has railroad communication, and communication by launch or steamer with adjacent waters. The bulkheads, forming the water front, have a sufficient depth alongside, and a vessel can usually find a berth. Provisions, anthracite and bituminous coal, some ship chandlery, gasoline, and water can be obtained. The river water is suitable for boilers at and above Elizabeth City. The largest marine railway is 205 feet long, with a capacity of 800 tons, and there are facilities for repairing machinery and the hulls of wooden vessels. Storm warnings are displayed.

ALBEMARLE SOUND TO BEAUFORT, N. C.

Albemarle Sound has depths of 10 to 18 feet along the tracks from North and Pasquotank Rivers to Croatan Sound, and less water farther eastward. In heavy weather the passage is uncomfortable and even dangerous for open boats. Fish stakes and nets, extending long distances from the shores, are often found on the shoals, especially at the northern entrance of Croatan Sound.

Croatan Sound, west of Roanoke Island, connects Albemarle and Pamlico Sounds, and is used by vessels bound through the sounds. A draft of about 8 feet can be taken through Croatan Sound when the water is at its ordinary level, and the channel is well marked for vessels of this draft; barges of 9 feet draft pass through the sound, but are liable to get aground. Strangers should not attempt to pass through Croatan Sound at night. Fish stakes and nets are numerous, especially at the northern and southern ends of the sound.

Roanoke Marshes is the name applied to the point and fishing station westward of Roanoke Marshes lighthouse. A crooked slough, from 50 to 100 yards wide, leads in a north and south direction across the point, and the fishing station with a number of small wharves is on this slough. A small vessel can enter either end of the slough, and make fast to the steep banks or at the wharves, with good shelter. The least depth at either entrance is 7 feet, and the depth in the slough varies from 12 to 16 feet. Both entrances are nearly blocked by fish stakes, but there is a narrow, clear passage. The north entrance is westward of the islet lying northward of the island on which the huts are located. A mid-channel course should be followed in the slough, and care is required when passing the opening between the islet and the island.

Roanoke Sound lies between Roanoke Island and a sand beach which separates it from the ocean. A depth of 6 feet can be carried from Albemarle Sound, through the northern part of Roanoke Sound, and through a dredged channel 100 feet wide into Shallowbag Bay to the wharves of the village of **Manteo**. There is a narrow channel, through which a draft of 4 feet can be carried close to the eastern side of Roanoke Island from Shallowbag Bay to Pamlico Sound; it is marked only at its southern end, and is not easily followed. **Shallowbag Bay** is a good anchorage for small craft of less

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than 6 feet draft. There is communication by power boats with Elizabeth City and neighboring villages, and facilities for hauling out vessels of 20 tons weight and 4 feet draft. **Nags Head** is a summer resort on the east side of Roanoke Sound, eastward of the north end of Roanoke Island; there is a depth of 4½ feet at the end of the wharf.

To enter Roanoke Sound from northward, pass northward of Collington Island Shoal light at a distance not greater than ¼ mile, and steer 101° true (**ESE ⅝ E** mag.) for 5 miles to Nags Head light, giving Roanoke Island a berth of over ⅝ mile. Pass northward and close eastward of Nags Head light and steer about 161° true (**S by E ¼ E** mag.) for 1½ miles to Dolbys Point light, passing eastward of a line of bush stakes. Pass 50 feet eastward of the light and steer about 216° true (**SW ⅜ S** mag.), passing eastward of a line of bush stakes. When the public wharf at Manteo is open from the point eastward, pass close northward of a bush stake, and steer about 271° true (**W ½ N** mag.) for the wharf. Anchorage can be had southeastward of the wharf, at a distance not greater than ¼ mile, also in the bay between the wharf and Ballast Point. A channel 100 feet wide has been dredged along the wharves.

Tides in Croatan and Roanoke Sounds depend entirely on the winds, which may, under exceptional conditions, lower or raise the level as much as 1½ feet from the normal; easterly winds lower the water and westerly winds raise it. Strong northerly or southerly winds produce currents, which are especially marked when the wind shifts suddenly to the opposite point.

Pamlico Sound is the largest body of water in North Carolina, and is separated from the Atlantic by a narrow beach extending from Bodie Island lighthouse to Cape Hatteras, a distance of about 35 miles, and thence in a west-southwesterly direction for about 35 miles. From Croatan Sound to the mouth of Neuse River the distance through the middle of Pamlico Sound is about 65 miles; the greatest width of the sound is about 24 miles. Oregon, New, Hatteras, and Ocracoke Inlets pierce the narrow beach, giving access to the ocean; but all are blocked by inside bars with little depth over them.

The northern and western shores of the sound are irregular, being broken by numerous small bays and by two large rivers, Pamlico River and Neuse River. The general depth of water in the middle of the sound is between 3 and 4 fathoms, but shoals in many places extend miles from the shore; northward of Ocracoke Inlet, Bluff Shoal, with 7 to 10 feet over it, extends completely across the sound.

Strong winds from any direction raise, in the exposed parts of the sound, a short, choppy sea, uncomfortable to small craft and even dangerous to open boats; but protected anchorage for small craft may be found in the many bays along the northern shore, and along the southern shore in several sloughs which lead to sheltered berths in the lee of shoals. Middleton Anchorage and the anchorage in the bight formed by the hook of Royal Shoal can be made either day or night, and are used.

Tides, except at the inlets, where there is a rise and fall of about 2 feet, are due entirely to winds and are small except under the influence of strong winds. Easterly and westerly winds produce the greatest change in water level, which rarely exceeds 2 feet. There are no noticeable currents except in the vicinity of the inlets.

Adams Creek entrance is on the south side of Neuse River 10 miles above Neuse River lighthouse, and southward of the town of Oriental, on the opposite side of the

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river. It is a part of the principal route between Pamlico Sound and Beaufort Harbor. A channel 10 feet deep has been dredged through Adams Creek, and thence through a canal and dredged channels in Core Creek and Newport River to Beaufort Harbor. This channel is well marked and easily followed in the daytime, and is good for vessels of 9 feet draft. The distances through the channel are as follows: Adams Creek entrance to north end of canal 5 miles, to south end of canal 10½ miles, to Morehead City bridge 16 miles. Two drawbridges cross the channel, one with a clear opening 65 feet wide over the canal 1 mile from its south end, and Morehead City bridge with a clear opening 50 feet wide.

DIRECTIONS, INSIDE ROUTE FROM NORFOLK TO BEAUFORT, N. C.

Local knowledge is required in a few places to carry the best water, but vessels drawing not over 8 feet, proceeding with care, and exercising extra caution in the few places mentioned, should be able to make the passage through either canal with the aid of the charts and these directions. Strangers are advised not to run at night.

The places requiring extra caution are the Southern Branch of Elizabeth River above the mouth of Deep Creek for the route by way of the Albemarle and Chesapeake Canal, and Deep Creek and parts of Pasquotank River by way of the Dismal Swamp Canal.

1. FROM NORFOLK TO CROATAN LIGHTHOUSE THROUGH THE ALBEMARLE AND CHESAPEAKE CANAL, 72½ MILES.—The *Southern Branch* of Elizabeth River has a length of 6 miles to the mouth of Deep Creek and 10½ miles to the lock at its head.

Entering the Southern Branch between Portsmouth and Berkley, follow a mid-river course until through the first bridge. Just above the bridge pass westward of a black buoy, steer about 199° true (**SSW ⅛ W** mag.) and pass about 200 feet off the lumber wharves on the western side and westward of a black buoy above them. Then steer 168° true (**S ⅝ E** mag.) and pass about 150 feet eastward of a red buoy. Then steer 201° true (**SSW ¼ W** mag.) through the draw of the second bridge. From the first to just above the second bridge the channel has been dredged 300 feet wide.

When above the second bridge pass southeastward of a red buoy and steer 247° 30′ true (**WSW ½ W** mag.) for ⅜ mile, passing the buoys at a distance of about 100 feet. When between a red and a black buoy, which mark the turn, steer 184° true (**S ¾ W** mag.) and pass about 200 feet off the wharves of the creosote works on the eastern side. Then pass between a red and a black buoy, which mark the turn, steer 230° true (**SW ⅞ W** mag.) and pass westward of the black buoys. Pass about 200 feet off the magazine wharf and haul southward and eastward, leaving the black buoys on the port hand, and pass about 200 feet off the lumber wharves on the southern side. When abreast the black buoy above them, steer 89° true (**E ⅜ S**

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mag.), heading midway between a red buoy and a small wharf on the northern side. When past the buoy, haul gradually southward for the draw of the third bridge, leaving the buoy about 100 feet on the starboard hand. From just above the second to the third bridge the channel has been dredged 200 feet wide.

From the draw of the third bridge slightly favor the eastern bank for ¼ mile, then favor the western bank for a distance of ½ mile, and then cross over so as to favor the eastern bank when abreast the mouth of Deep Creek. Thence to the Albemarle and Chesapeake Canal, at the head of Southern Branch, the channel has a width of 100 to 200 feet and is not easily followed. In general it follows the "*ebb tide bends*"; that is, the channel favors the upstream and avoids the downstream side of points. The safest time for a stranger is on a rising tide.

From off the mouth of Deep Creek follow the eastern bank, passing eastward of the red and black horizontally striped buoy off the mouth of the creek and eastward of the red buoy above it. Then change course gradually to 195° true (S by W ¾ W mag.) and favor the west bank from the point on that side to the wharf of the burned mill just below the fourth bridge.

Then pass through the draw and follow the west bank from the next point on that side to the black buoy just above it. Then haul over gradually so as to follow the east bank for a short distance above the next point on that side; and then follow the west bank from the point on that side, through the draw of the fifth bridge, and to the bend ¼ mile above the bridge.

Here the river turns to about east-northeast, and the north bank should be followed until past the red buoy, which lies in the next bend. Then keep near mid-river and favor the west bank when passing the black buoy in the next bend. Then haul gradually eastward, follow the north bank, and pass in mid-channel northward of an islet.

Follow the south bank above the islet, leaving three black buoys on the port hand, and from the last buoy steer northeastward and follow the middle of the narrow part of the river around the next bend, where there is a black buoy. Then favor the east bank until up with another black buoy, and then favor the west bank in passing the bulkhead of the Richmond Cedar Works on that side. From there to the canal lock, a distance of ¾ mile, the river has an easterly direction, and the north bank, if either, should be favored.

NORTH LANDING RIVER, CURRITUCK SOUND, AND COANJOCK BAY TO LIGHT NO. 9, 29½ MILES.—North Landing River from the canal to light No. 1, a distance of 10½ miles, is 100 to 300 feet wide and has a depth of 9 feet or more. It is crooked, but the bends are as a rule easy. Vessels should keep in the middle of the river and give the points a good berth in rounding them. Some trouble may

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be experienced from snags or sunken logs. Two or three branches in the upper part of the river might confuse a stranger, but with the aid of the chart no trouble will be had from this cause. About 3 miles below the canal a branch nearly as wide as the river leads eastward; some piles are driven partly across its mouth. About 1½ and 3½ miles below the canal branches lead westward, but noticeable only when approaching from southward. A shoal, formerly marked by a stake, extends to mid-channel from the south side of the point 1 mile above (northward of) light No. 1.

Between lights Nos. 1 and 9, a distance of 19 miles, the channel is a dredged cut, 80 feet wide and 9 feet deep, and is easily followed by means of the lights, which are placed at the turns, and the brush stakes which mark one side of the cut. Between lights Nos. 1 and 2 and 7 and 8 the brush stakes are on the western side of the cut, and between lights Nos. 2 and 7 the brush stakes are on the eastern side.

Passing eastward of light No. 1, the course is about 107° true (**ESE** mag.) for ½ mile to light No. 2, which is on the eastern side of the cut; then 155° true (**S** by **E** ¾ **E** mag.) for 2⅜ miles to light No. 3, which is on the western side; then 164° true (**S** by **E** mag.) for 4⅞ miles, passing light No. 4 and to light No. 5, which are on the eastern side; then 133° true (**SE** ¼ **S** mag.) for 2⅜ miles to light No. 6, which is on the eastern side; then 163° true (**S** by **E** mag.) for 2⅛ miles to light No. 7, which is on the western side (a station of the Lighthouse Service is on the western side of the cut just southward of this light); and then 188° true (**S** by **W** ⅛ **W** mag.) for 1 mile to light No. 8, which is on the western side at the entrance of the canal.

From light No. 8 the course is 171° true (**S** ⅜ **E** mag.) for 2⅝ miles to abreast a light on the east side, and the sides of the canal are partly bare and easily followed. From here to North River the canal has a 204° true (**SSW** ⅝ **W** mag.) direction for 2¼ miles. Thence the dredged cut has a 216° true (**SW** ⅜ **S** mag.) direction for ½ mile to light No. 9, and is marked on its west side by brush stakes and the light.

NORTH RIVER AND ALBEMARLE SOUND TO CROATAN LIGHTHOUSE, 25 MILES.—Follow the brush stakes which extend ¼ mile southward of light No. 9, and then keep in mid-river for a distance of 1½ miles southward of the light until up with a red buoy. Pass westward of the buoy, and then favor the north side for a distance of 1 mile until through the narrowest part of the river. Then keep in mid-river, passing eastward of a shoal sometimes marked by a brush stake, and then favor slightly the point on the west side in making the turn westward. Then steer about 234° true (**SW** by **W** ¼ **W** mag.) and pass about 150 yards northward of the point on the south side where the river turns southward to light No. 10. Then keep in mid-river, pass westward of a red buoy just above light No. 10, pass 200 yards

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southwestward of the light, and steer 130° true (SE mag.) for ¾ mile. Then steer 150° true (SSE ¼ E mag.) for 5¼ miles, giving the shores a berth of over ⅜ mile, and pass southward of the front light of the North River Bar range. Then bring the two lights in line astern on a 185° 30′ true (S by W mag.) course, and cross the bar on this range, passing westward of the red buoys. The range leads through a dredged cut, which is 80 feet wide and about 9 feet deep.

When across the bar and past the red buoy, lying about ¾ mile southward of North River lighthouse, steer 161° true (S by E ¼ E mag.) for 7½ miles. Then steer 145° true (SSE ⅝ E mag.) for 4¾ miles to a position about 250 yards eastward of the black buoy lying 1 mile north-northwestward of Croatan light; this light should be a very little on the starboard bow on this course. Then steer 152° true (SSE mag.) for Croatan light, and on nearing it change the course so as to pass 250 yards westward of it. Then follow the directions in section 2.

1 A. THROUGH THE DISMAL SWAMP CANAL—DEEP CREEK, 2½ MILES.—Follow the directions of section 1 for the Southern Branch of Elizabeth River to the mouth of Deep Creek, and pass about 100 feet northward of the red and black horizontally striped buoy and nearly that distance southward of the red buoy in entering the creek. The channel in Deep Creek has been dredged about 100 feet wide and generally has little water on both sides of it. If near low water the sides of the channel are generally indicated by the swash from the vessel's passage, and otherwise there is nothing to mark it. For a distance of 300 yards inside the entrance to the first bend the channel favors the north bank, and then for a further distance of 300 yards until halfway to the next bend the channel favors the west bank. The channel then follows the middle of the creek, except in its widest part, ⅝ mile below the canal lock, where it follows the north bank.

Turners Cut is 3¾ miles long, and the only directions necessary are to keep in the middle. From the lock of the Dismal Swamp Canal it has a 171° true (S ⅜ E mag.) direction for ⅜ mile, and then about 141° true (SE by S mag.) direction for 3⅜ miles to Pasquotank River. About ⅝ mile below the lock the old river crosses the cut in a north and south direction. At the southerly end of the cut the old river joins it from west-southwestward.

PASQUOTANK RIVER FROM TURNERS CUT TO ELIZABETH CITY, 12½ MILES.—In the following description the terms "right" and "left" banks are applied as seen when bound southward. Several branches, which enter from the right or western bank of the river are liable to confuse a stranger; the rule is to keep to the left passage, bound southward. On account of some sharp bends in the narrow parts of the river and shoal water in the broader parts, strangers are advised to proceed

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with caution in its uncharted part above Elizabeth City. It is also advisable to keep the leads going on both sides, as the slope on either side of the channel is usually sufficient to make the difference in depth obtained with the two leads an indication of where the deeper water lies.

From Turners Cut to the point on the right bank just below Coopers Creek, a distance of 4½ miles, the river gradually widens from 100 to 300 feet, and a mid-river course should be followed. At this point the river widens suddenly, and the channel, which is a dredged cut 150 feet wide with a least depth of about 7 feet on either side, favors the left bank, following it at a distance of about 300 feet until around the next point on the left bank about ⅝ mile farther down. Here the dredged channel leads between two buoys and takes a 148° true (**SSE** ½ **E** mag.) direction to a position 350 feet off *Shipyard Landing* (on the left bank 5½ miles below Turners Cut). Then change course gradually to 189° true (**S** by **W** ¼ **W** mag.) and pass 100 feet off the point on the right bank just below Shipyard Landing. Continue the course to mid-river, and so continue in the narrower part of the river around the next bend until approaching Goat Island.

When 6¼ miles below Turners Cut pass in mid-channel northeastward of *Goat Island,* which is ¼ mile long and has a black buoy at its upper and lower ends. Favor the left bank just below the island until abreast the mouth of the creek on the left bank. Then keep in mid-river. The Norfolk & Southern Railroad bridge crosses the river 9⅝ miles below Turners Cut; the draw has a clear width of 48 feet. In rounding the sharp point 10¾ miles below Turners Cut, the bight may be favored slightly just above and below the point to assist in making the turn, but keep near mid-river off the point itself. Then keep in mid-river, favor the log boom and lumber wharf on the right bank in rounding the next point on that side, and then favor slightly the right bank until through the lift bridge at Elizabeth City, which is 12½ miles below Turners Cut. Vessels may go alongside the wharves at Elizabeth City, either above or below the bridge; anchorage is usually made around the bend below the bridge.

PASQUOTANK RIVER AND ALBEMARLE SOUND FROM ELIZABETH CITY TO CROATAN LIGHTHOUSE, 31 MILES.—From the lift bridge favor the wharves of Elizabeth City, pass southward of a red buoy, and then steer 96° true (**E** by **S** mag.) for Hospital Point (on north shore) until in mid-river. Then steer 117° true (**SE** by **E** ⅛ **E** mag.), pass 100 yards northward of Cobb Point light, and continue the course 2½ miles past the light to a position ⅝ mile off the western shore below Brick House Point. Then steer 136° true (**SE** ½ **S** mag.) for 7½ miles with Anson Point astern, leaving a red buoy nearly ¼ mile on

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the port hand, a black buoy ¼ mile on the starboard hand, and Poquoson Point light ¼ mile on the port hand. From a position ½ mile southward of Poquoson Point light steer 106° true (**ESE ⅛ E** mag.), give the shore a berth of over ½ mile, and pass ⅜ to ½ mile northward of Wade Point lighthouse.

When Wade Point lighthouse bears 265° true (*W* mag.) distant 1 mile, steer 145° true (**SSE ⅝ E** mag.) for 14½ miles to a position about 250 yards eastward of the black buoy lying 1 mile north-northwestward of Croatan lighthouse; the lighthouse should be made and kept a very little on the starboard bow on this course. Then steer 152° true (**SSE** mag.) for Croatan lighthouse, and on nearing it change the course so as to pass 250 yards westward of it. Then follow the directions in section 2.

2. FROM CROATAN LIGHTHOUSE TO BEAUFORT HARBOR ENTRANCE, 110 MILES.—The following directions are good for vessels of 8 feet or less draft.

CROATAN SOUND.—Pass 250 yards westward of Croatan lighthouse and close eastward of buoy No. 7, and steer 125° true (**SE ⅜ E** mag.) for nearly 1 mile with the tangent to the shore near Caroon Point astern. When a 144° true (**SSE ¾ E** mag.) course will lead 75 to 100 yards westward of buoy No. 6, steer this course for a little over 1 mile to a position about 100 yards eastward of buoy No. 5. Then steer 127° true (**SE ¼ E** mag.), pass about midway between buoys Nos. 4 and 3, and pass 200 yards northeastward and eastward of Blockade Shoal light. Then steer 169° true (**S ½ E** mag.) for 5⅜ miles, and pass 50 to 100 yards eastward of Roanoke Marshes lighthouse.

PAMLICO SOUND.—Then bring Roanoke Marshes lighthouse astern on a 177° true (**S ⅛ W** mag.) course, passing eastward of a black buoy and well westward of a horizontally striped buoy, until 3 miles from the lighthouse. Then steer 164° true (**S** by **E** mag.) for 4¼ miles, giving the shore a berth of about 1½ miles, until Stumpy Point bears 254° true (*W* by *S* mag.). Then steer 178° true (**S ¼ W** mag.) for 10 miles until Long Shoal lighthouse bears 310° true (*NW* mag.) distant 2⅜ miles.

Then make good a 225° 30′ true (**SW ½ W** mag.) course for 27½ miles to a position ¼ mile southward of Bluff Shoal lighthouse. Then make good a 246° true (**WSW ¼ W** mag.) course for 11¾ miles to a position ½ mile southward of Brant Island Shoal lighthouse. Then make good a 265° true (**W ⅛ S** mag.) course for 9¼ miles to a position northward of Point of Marsh black buoy, with Point of Marsh light bearing 201° true (*SSW ¼ W* mag.) distant 1¼ miles. Then make good a 236° true (**SW** by **W ¼ W** mag.) course for 11¼ miles, passing nearly ¾ mile southward of Neuse

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River lighthouse, ⅜ mile southward of the red buoy marking Gum Thicket Shoal, and to a position ¼ mile northward of Garbacon Shoal light.

From a position ¼ mile northwestward of Garbacon Shoal light steer 212° true (**SW ¾ S** mag.) for 2¼ miles, heading for the point on the south side of the river westward of Adams Creek. When Adams Creek light bears 154° true (**SSE** mag.) distant ¾ mile, steer this course and pass 100 to 150 yards eastward of the light.

Vessels of 6 feet or less draft can follow the north shore of Pamlico Sound more closely, as follows:

Bring Roanoke Marshes lighthouse astern on a 177° true (**S⅛ W** mag.) course, giving the shore a berth of about 1 mile, until 7½ miles from the light and Stumpy Point bears 265° true (*W* mag.). Then steer 184° true (**S ¾ W** mag.) for 7 miles, heading for Long Shoal lighthouse. Cross Long Shoal about ⅜ mile northwestward of the lighthouse and steer 225° 30′ true (**SW ½ W** mag.) for 17 miles, to a position ¼ mile southward of Gull Shoal lighthouse. Then steer 239° true (**SW by W ⅝ W** mag.) for 15½ miles, passing ½ and 1 mile, respectively, southward of two red buoys and to the horizontally striped buoy at the southeast end of Lower Middle. Then steer 249° true (**WSW ½ W** mag.) for 8 miles, heading for Brant Island Slue light. Pass about 250 yards southward of this light and steer 232° 30′ true (**SW by W** mag.) for 6 miles, to a position northward of Point of Marsh black buoy.

ADAMS CREEK TO BEAUFORT HARBOR ENTRANCE, 20 MILES.—The dredged cuts are 250 feet wide in Adams Creek to Isaacs Creek light, thence 125 feet wide to North Entrance Canal light, 90 feet wide in the canal to Core Creek, 125 feet wide in Core Creek, and thence 250 feet wide to Beaufort Harbor.

Passing 100 to 150 yards eastward of Adams Creek light, steer 168° true (**S ¾ E** mag.) for the water tank near the wharves on the west side. Leave the black buoy 125 feet on the port hand and steer about 129° true (**SE ¼ E** mag.) with Dumpling Creek light a little on the starboard bow.

Leave Dumpling Creek light 125 feet on the starboard hand and steer about 148° true (**SSE ½ E** mag.) with Cedar Creek light a little on the starboard bow; a white post will be in range with a tall tree astern on this course.

Leave Cedar Creek light 125 feet on the starboard hand and steer 207° true (**SSW ¾ W** mag.) with Isaacs Creek light a little on the starboard bow. Leave Isaacs Creek light about 75 feet on the starboard hand and steer 242° true (**SW by W ⅞ W** mag.) for North Entrance Canal light with a slatted beacon astern. This course should lead about 125 feet off the notice board on the north bank

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and then near mid-creek. Leave North Entrance Canal light about 60 feet on the starboard hand, steer 216° true (**SW ½ S** mag.) with a slatted beacon ahead and astern, and keep in mid-creek or favor the west bank slightly in rounding the next point on the east side.

Keep in mid-channel through the canal, the limit of speed being 5¼ miles (6 statute miles) per hour.

CORE CREEK AND BEAUFORT HARBOR.—From the south end of the canal steer 192° true (**S by W ⅜ W** mag.) for ⅜ mile in the first section of the dredged cut with two white posts in range astern until 250 yards from Core Creek upper light; the grass marks the east side of this dredged cut, but on the west side is a flat bare at low water. Then steer 178° true (**S ⅛ W** mag.) for 1¾ miles with Core Creek range lights in line ahead, passing 75 feet eastward of Core Creek upper light; the sides of the cut are flats bare at low water.

Leave buoy No. 10 about 100 feet on the port hand and steer 144° true (**SSE ¾ E** mag.) for 1 mile with Russells Creek light a little on the starboard bow; two beacons will be in range ahead on this course. Leave this light 125 feet on the starboard hand and steer 199° true (**SSW** mag.) for 1¼ miles, with two beacons in range astern. Leave Newport Marshes upper light about 125 feet on the starboard hand and steer 226° true (**SW ⅜ W** mag.). Pass midway between Newport Marshes lower light and buoy No. 8, steer 201° true (**SSW ¼ W** mag.) for the end of the wharf house which shows over the bridge a little to the right of the draw, and steer for the draw when less than 300 yards from it.

From the draw steer 178° true (**S ⅛ W** mag.) to a position 100 yards eastward of a horizontally striped buoy, and then steer 165° true (**S by E** mag.) until approaching the marsh on the southern side. Then steer southeastward, follow the marsh at a distance of 125 yards, and leave buoy No. 6 on the port hand. When past this buoy give the shore a berth of over 150 yards and steer about 117° true (**SE by E ¼ E** mag.) to a position about 100 yards westward of buoy No. 4. Then steer about 154° true (**SSE** mag.) for a horizontally striped buoy, which is on the eastern side of the channel. Pass about midway between this buoy and buoy No. 1 and steer 200° true (**SSW ⅛ W** mag.) with Bird Island range lights in line astern until up with the perpendicularly striped buoy, which is on the bar at the intersection of the ranges. From this buoy steer 217° true (**SW ⅜ S** mag.) with Shackleford Point range lights in line astern until up with Entrance bell buoy, from which a course can be shaped as desired.

Anchorage can be had in the channel of Beaufort Harbor from Morehead City bridge to Fort Macon, and vessels of 8 feet or less draft can anchor, convenient to Morehead City, in the channel of Bogue Sound westward of buoy No. 3.

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BEAUFORT TO WINYAH BAY.

There is no inside passage from Beaufort, N. C., to Winyah Bay, a distance of about 160 miles, and vessels must pass outside between these points. Cape Fear River, halfway between them, is available as a harbor, the navigable distance to which from the entrance buoy off Beaufort Harbor by way of Frying Pan Shoals light vessel is 112 miles. Except as stated below all vessels must pass outside Frying Pan Shoals, for which route the following courses can be used:

From the entrance buoy off Beaufort Harbor 221° true (**SW** mag.) for 86 miles to Frying Pan Shoals light vessel, and then 252° true (**WSW ⅝ W** mag.) for 67 miles to Georgetown whistling buoy.

Boats of 4 feet draft can be taken inside from Beaufort to Bear Inlet, a distance of 25½ miles, and 3 feet draft to New River Inlet, 35 miles from Beaufort. With local knowledge, a smooth sea, and high water, boats up to 5 feet draft can enter Cape Fear River through Corncake Inlet, and boats up to about 6 feet draft can cross Frying Pan Shoals by the swash channel. Light-draft boats can follow the coast from Beaufort, Bear Inlet, or New River Inlet to Cape Fear, and from there to Winyah Bay, and be in a position to enter the inlets if desired. The inlets and inland waters are described with the coast from Cape Lookout to Cape Fear and from Cape Fear to Winyah Bay.

WINYAH BAY TO CHARLESTON.

The distance from Winyah Bay to Charleston is about 70 miles through inside waterways and passages; the shortest distance outside, over navigable waters, between the same points is about 62 miles. A draft of 4 feet can be carried through at mean low water. Charts 153 and 154 are the best guides.

Tides and tidal currents are found at all parts of this inside passage. The mean rise and fall of tides varies from 3.5 to 5 feet, depending upon the distance from the inlets. During freshet conditions there are ebb currents in the Santee Rivers and Six Mile Creek amounting to 3 or 4 knots.

The *Estherville-Minim Creek Canal* enters the southwest side of Winyah Bay, ¼ mile westward of light No. 3 and about 7 miles below Georgetown. The canal is reached by the dredged channel to Georgetown, which here lies close to the western shore.

The canal is 4⅛ miles long, 40 to 50 feet wide, and about 6 feet deep; it leaves Winyah Bay in a southwesterly direction, thence curves south to Minim Creek; the southern entrance, in Minim Creek, is marked by a black and white striped beacon on the east bank of the canal. A ferry crosses the canal at Smithville, 1¾ miles from the northern entrance.

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Leaving the canal go southward in *Minim Creek* for ½ mile to its mouth; and then take the passage northward of Little Crow Island, favoring the north bank for ½ mile and then favoring Little Crow Island to its western end. Then follow the shore of Crow Island to its western end (there are two large cedars in the water off this point). The distance from the canal to this point is 2 miles, and the least depth is 6 feet at low water.

Cross over to the south bank of *North Santee River* and follow the ebb-tide bends about 3½ miles up the river to Six Mile Creek, which enters the south bank of the river.

Six Mile Creek is about 3 miles long, from 150 to 200 feet wide, and 10 to 20 feet deep; it joins the North and South Santee Rivers. During freshets the water runs each way from Dark Creek and attains a velocity of 3 or 4 knots, but ordinarily the ebb current runs through from South Santee to North Santee.

From North Santee River pass up Six Mile Creek for 1½ miles to *Pleasant Creek*, and then go down the latter for nearly 3 miles to South Santee River. The passage through these creeks is not difficult, except that some of the bends are sharp. Pleasant Creek averages about 100 feet wide and is 10 to 20 feet deep.

Entering *South Santee River*, from the middle of the entrance of Pleasant Creek steer about 106° true (**ESE ½ E** mag.) and exercise care until 200 yards below the mouth of the creek, as the channel is narrow between shoals. Pass north of Brown Island, keeping close to the north bank, and follow this bank down to Alligator Creek, 1½ miles below Plesasant Creek.

Alligator Creek runs from the south bank of South Santee River, ¾ mile below Brown Island, 6¼ miles westward and southward to the ocean near Cape Romain Harbor; it is about 4 feet deep. In general the banks are steep and well defined, but at a few places mud flats reach out for a few yards. A small beacon (white boarded tripod, No. 1) marks the end of an oyster rock at the western side of the entrance from sea. A broad sand bank extends southward from the point on the other side of the mouth of the creek.

Cross over from the north bank of South Santee River and enter Alligator Creek close to the eastern side to avoid a mud flat extending nearly across the creek from the western side at the entrance. Then follow a mid-channel course, keeping clear of the points at bends, and when down to an island take the passage eastward of it. Avoid the eastern shore near the mouth and pass out close to the beacon, leaving it on the starboard hand.

From the beacon steer about 151° true (**SSE ½ E** mag.) for ⅞ mile, and then haul southwestward, passing red buoy No. 2 close to on the starboard hand, and round the low sand spit at the north end

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of Cape Island into *Cape Romain Harbor*. Cross the harbor in a 201° true (**SSW** mag.) direction and enter the short passage north and west of Marsh Island. Through this passage keep close to the northwest bank, avoiding Marsh Island after passing it close to at the northern entrance. The distance from Alligator Creek to Romain River is 4 miles and the least depth 4 feet.

Follow the ebb tide bends for 5 miles up *Romain* River, and then for 2 miles up *Five Fathom Creek* to the mouth of Town Creek; the channel is not difficult with the aid of chart 153. *Town Creek* trends northward for 1 mile to *McClellanville*, and has a channel 60 feet wide and 4 feet deep which is marked on its west side by piles.

From the mouth of Town Creek go northwestward and westward through the dredged channel in *Mathews Creek* and *Cut*. There is a sawmill and wharf on the north bank of the cut; the distance through creek and cut is about 2 miles. Leaving the cut, follow *Harbor River* southwestward, passing west of a mid-channel shoal in the first reach and south of an island in the second reach; thence in mid-channel for about 3 miles to Owendaw Creek.

Go up *Owendaw Creek* about 2 miles, passing east of an island near the river, to a short canal through the south bank to *Graham Creek*. Pass through this canal and down Graham Creek to the bend at the head of the first reach above Bull Bay. Enter a canal here leading to *Saltpond Creek*, and pass through it and down that creek to the head of the first reach above Bull Bay; thence through a canal to *Belvedere Creek* and down to the mouth of that creek; thence through a canal, the east side of the north entrance to which is marked by a stake, across the marsh between Belvedere and *Vanderhost Creek;* thence up Vanderhost to the first bend, and through a canal to Van Ross Creek. There is a driven well on the north bank of Van Ross Creek, just above this canal, and boats can get water here conveniently.

Follow *Van Ross Creek*, keeping to the starboard hand at branch passages, to its head in *Sewee Bay* and steer 213° true (**SW** by **S** mag.) into the middle of the bay through a staked channel until abreast some houses on the west bank. Then steer southward and then eastward through a staked channel into *Sewee Creek*. Follow this creek down to the forks about ⅝ mile from Bull Bay, which will then be open ahead between the shores of the creek, and then take the south branch back into Hickory Bay.

Cross *Hickory Bay* on a course about 184° true (**S** ½ **W** mag.) for nearly ½ mile in a staked channel, and then steer southwestward, southward, and then eastward through a staked channel and leave the bay by a creek which winds through the marsh in a general easterly direction and then trends southward to Bull Creek.

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streams and passages are tidal and are subject to a mean rise and fall of from 5 to 7 feet.

CHARLESTON TO ST. HELENA SOUND, 55 MILES.— *Wappoo Creek* and *Elliott Cut* have a length of 3 miles and a least depth of 7 feet. Wappoo Creek enters Ashley River through its west bank about 1 mile above the Battery, the south water front of Charleston, and is marked on the north side of the entrance by Wappoo Cut light. Elliott Cut light marks the south side of the cut at the entrance from Stono River.

From the horizontally striped buoy southward of Charleston stand up the Ashley River until abreast of Wappoo Cut light, keeping well over to the city side. Pass about 125 feet southward of Wappoo Cut light on a 239° true (**SW** by **W** ¼ **W** mag.) course, favor the south bank of Wappoo Creek for a distance of ½ mile, then the north bank to the next bend, and then the south bank to the bridge, the opening in which is on the north side of the center pier. Then follow the ebb-tide bends in the crooked part of the creek for a distance of ½ mile above the bridge. Pass in mid-channel through New Cut, leaving two openings on the starboard hand, and then favor well the north bank until approaching the next bend. Then keep in mid-channel in a cut through the marsh and through Elliott Cut.

Stono River has a length of 13 miles from Elliott Cut to Wadmelaw River, and a least depth of 6 feet at Church Flats. The channel in the broader part of Stono River follows the ebb-tide bends as shown on chart 154; with the exception of Church Flats, the river is not difficult.

From the west end of Elliott Cut cross Stono River on about a 273° true (**W** ⅜ **N** mag.) course, and keep close to the south bank for a distance of 1 mile, nearly to the bend. Then favor the north side as far as the phosphate works and wharf at the next bend; then favor the southern side nearly to the wharf, which is just below the next bend. Favor the north side of this bend and the south side at the bend ½ mile above. Favor the south side for a distance of ½ mile above the last bend, and then the north side nearly to the wharf and phosphate works on the north bank. A middle ground, with 5 feet over it and slightly deeper water on either side, lies nearly ¼ mile above the wharf; when past the middle ground keep about in midstream for ⅝ mile to Rantowles Creek; there are two branches here, both narrow streams.

Enter the southern opening and steer midstream courses for about 4 miles to *Church Flats*, where the creek widens. The channel through Church Flats is narrow and difficult but is good for 6 feet at low tide; it is marked by two beacons, square white targets, numbered 1 and 2, on single piles. Tides meet about 1 mile eastward

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of Church Flats. Leave Beacon No. 2 close-to on the starboard hand and beacon No. 1 close-to on the port hand, and then favor the eastern side to the next bend. For the next 2 miles, to Wadmelaw River, the best water is near the outer sides of the bends and about in midstream between the bends. Follow the ebb-tide bends and give the points a good berth when turning at the bends.

Wadmelaw River has a length of 9½ miles from New Cut to the junction of North Edisto and Dawho Rivers and a depth of 10 feet or more. The upper waters of Wadmelaw River are broad and are filled with small islands and shoals, between which the channel winds and is difficult; it is marked by three lights.

Leaving New Cut, from Stono River hold to the south bank in the bend; then pass midway between the small islands on the starboard hand and a wharf and islet on the port and steer a little southward of light No. 3. Leave this light about 75 yards on the starboard hand and then follow the curve of the channel to light No. 1, keeping, if anything, a little westward of a line joining lights Nos. 3 and 1 when halfway between them. Leave light No. 1 about 50 yards on the starboard hand, haul gradually westward so as to favor the south side at a distance of 150 yards, and round light No. 2 at a distance of about 75 yards. Then follow the east bank at a distance of 75 yards, pass this distance off the two wharves in the bend, favor slightly the south bank to the next bend, and then favor the west bank to Youngs Village.

Youngs Village is a small settlement and railroad terminus on the right bank of Wadmelaw River. It is connected with river towns and settlements by steamboats. Gasoline and some supplies can be obtained here. Storm warnings are displayed. A depth of 7 to 8 feet can be taken alongside the wharf.

At Youngs Village favor the right bank down to the wharf; pass about 75 yards north of the little wooded islet south of the village, and steer 236° true (**SW** by **W** mag.) for Martins Point, on the left bank at the turn. At Martins Point hold over to the right bank and keep close under this bank until abreast the wharf and houses on the opposite bank, ½ mile from Martins Point; then favor the left bank, passing south of an islet opposite a long wharf on the left bank. Favor the left bank past several marshy islands below the wharf, and pass 200 yards off the ruins of the wharf at Bluff Point. Then steer 219° true (**SW** ½ **S** mag.) for White Point at the mouth of Dawho River, and give the point a berth of 200 yards.

Dawho River enters North Edisto River south of White Point, and winds through the marshes 12 miles to South Edisto River. It varies in width from about 75 yards to over 700 yards, and has a deep, well defined channel, except through the broader waters near the North Edisto, where the difficult part of the channel is marked

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by beacons; white targets with odd numbers are left on the port hand, and red targets with even numbers on the starboard hand, going westward. Thence to South Edisto River, the narrow part of the river is not difficult, although some of the bends are not easily made by anything but small craft. The least depth in the river is about 6 feet. The entrance from South Edisto River is so narrow and, as approached from that river, resembles so closely some of the small drainage streams, that a stranger might pass it by mistake; an old shack and wharf on the south bank, just inside the opening, serves to mark this entrance. Tides meet in the Dawho River about 2 miles from the South Edisto entrance.

Entering Dawho River follow the north bank at a distance of 200 yards for ⅜ mile, and then steer 205° true (**SSW ¼ W** mag.), passing 100 yards northwestward of beacon No. 1 (which is close to the northwest side of a marshy islet) and 75 yards southeastward of beacon No. 2. Then haul gradually westward, pass 100 yards or more southward and 75 yards westward of beacon No. 4, and steer 352° true (**N ⅝ W** mag.) for beacon No. 6 until about 200 yards from it.

Leave beacon No. 6 about 75 yards on the starboard hand, and bring it astern on a 269° true (**W ⅛ S** mag.) course, passing 50 yards northward of beacon No. 3. Continue the course about ¼ mile past beacon No. 3, leaving a large shoal, sometimes marked by beacon 8, on the starboard hand and a small oyster bank, partly bare at low water, on the port hand. From the last position come slowly to about a northwest course and follow the marshes on the northern bank at a distance of 125 yards until up to the first bend; then steer mid-channel courses, and favor the outside bank at the bends.

At North Creek, about 5 miles above the last beacon, take the starboard hand passage. At the cut-off, 1¼ miles farther up stream, avoid turning too soon into the new passage, as a shoal makes well off the point on the northern side of the passage; just northeastward of this point, where a sounding of 6 feet is shown on chart 154, the eastern bank should be favored.

South Edisto River has a length of about 13 miles from Dawho River to Fenwick Island Cut, and a least depth of about 6 feet. The channel follows the ebb tide bends as shown on chart 154, and is not difficult with the exception of the crossing 1 mile below Dawho River.

From Dawho River follow closely the eastern bank of South Edisto River for ½ mile until abreast the western end of a small island. Then steer 244° true (**SW by W ¾ W** mag.) with a bushy cedar tree a little on the port bow, crossing to the western bank through a narrow channel with a depth of 6 feet; to make this

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crossing from southward follow the west bank until up with some piles near that bank, and then cross on a 64° true (**NE** by **E** ¾ **E** mag.) course.

Follow the west bank closely to the bend, the south bank nearly to the next bend, the west bank around this and the next bend, the south bank in the reach eastward, and the east bank in the next bend. Then favor slightly the east bank until abreast an old landing; then steer about 213° true (**SW** by **S** mag.) to the west bank, and follow it closely nearly to the next bend. Then steer about 143° true (**SE** ¾ **S** mag.) to the east bank at the mouth of a stream about 300 yards northward of an old house and some outbuildings, and favor this side for 1 mile. Then steer 250° true (**WSW** ¼ **W** mag.) for a tall tree on the west bank, and follow that bank closely for 1 mile to *Fenwick Island Cut*, which is a canal between South Edisto and Ashepoo Rivers, 100 feet wide and 7 feet deep; its high, reddish slopes are visible from both rivers.

Ashepoo River has a length of 4½ miles from Fenwick Island Cut to Combahee Bank beacon in St. Helena Sound, and is not difficult. From Fenwick Island Cut turn southward down the middle of Ashepoo River for 1½ miles until nearing its mouth. Then favor the west bank and steer 209° true (**SSW** ⅝ **W** mag.) to buoy No. 2, which is left on the port hand. Then steer about 199° true (**S** by **W** ¾ **W** mag.) to buoy No. 1, which is left on the starboard hand. Then steer about 169° true (**S** by **E** mag.) and pass eastward and southward of Combahee Bank slatted beacon, rounding it at a distance of at least ¼ mile.

ST. HELENA SOUND TO PORT ROYAL SOUND, 31½ MILES.—There are two inside routes between St. Helena Sound and Port Royal Sound; the principal one by way of Coosaw River, Brickyard Creek, and Beaufort River, past Beaufort and Port Royal; and the other by way of Harbor River, Story River, and Station Creek. The distance by the former, or inland route, is about 31½ miles, and the least depth, at low tide, is 7 feet; while the distance by the latter, or coast route, is about 26 miles, and the least depth about 4 feet. The former is decidedly easier for a stranger; but the latter route can be used by a draft of 3 or 4 feet, and at high water may be shortened 3 to 4 miles by crossing a shoal in St. Helena Sound.

INLAND ROUTE.—The distance from Combahee Bank beacon to Brickyard Creek is 13 miles, and the route is not difficult.

St. Helena Sound.—From a position ⅜ mile southward of Combahee Bank beacon steer 298° true (**NW** by **W** ½ **W** mag.) for 1¾ miles, passing can buoy No. 5 PB and nun buoy No. 4 at a distance of about 300 yards. From the latter buoy steer 307° true (**NW** ⅝ **W** mag.), passing can buoy No. 7 and the north shore ¾ mile above it

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All canals and the dredged channels in Sewee and Hickory Bays are 60 feet wide and 4 feet deep. The distance from Owendaw Creek to Bull Creek is about 11½ miles.

From *Bull Creek* continue westward past an opening into Sewee Bay, and through a canal that cuts off the southern loop of Bull Narrows, into Price Creek, a distance of 2¾ miles. Cross Price Creek and enter Santee Pass, ⅛ mile upstream on the opposite side.

Santee Pass makes several sharp bends but is easily followed; at the end of the first reach there is a stream leading northward; at the end of the third reach the channel is separated from *Mark Bay* by little islets, and just west of here are streams, one leading eastward and one westward. Follow the pass through to *Caper Creek*, keeping close to the left bank after entering the broader water; round the west end of Caper Island at a distance of 200 feet, and follow this shore southeastward nearly to abreast the eastern point of the opposite shore (Dewees Island). The distance from Price Creek to this position is 4¼ miles.

Cross over to the eastern point of Dewees Island and follow its north shore westward, keeping it aboard at a distance of 100 feet when past the entrance of a slue in Dewees Island until in the creek and abreast its north entrance point. Then follow this creek westward to Bullyard Sound.

Cross *Bullyard Sound* on a 259° true (**W ⅞ S** mag.) course through a dredged cut 60 feet wide and 4 feet deep, which is marked on its north side by piles. Then go through two other dredged cuts in the sound which are marked by range beacons and side stakes, courses about 196° true (**S** by **W ½ W** mag.) for ½ mile, and then 224° true (**SW** mag.) for ½ mile until in the short arm which leads southsouthwestward to Dewees Creek. The distance from Caper Creek to Dewees Creek is 3 miles, and the least depth is 4 feet.

Entering *Dewees Creek* follow a mid-channel course westward up this creek to *Hamlin Sound;* thence along the southern side of the sound and out between this sound and *Gray Bay*, through a dredged channel, to *Hamlin Creek*. The channel through the sound is defined by islets and oyster banks on the northern side, separating it from the open water of the sound, and in the vicinity of Gray Bay by piles surmounted by black barrels, along the eastern side of the channel. These piles should be left at a distance of 20 to 30 feet on the port hand. In Hamlin Creek, below the second bend, there is a small mid-channel islet that should be left on the starboard hand, going west. Continue down Hamlin Creek to the *Isle of Palms*, a summer resort on a narrow strip of beach between this creek and the ocean, favoring the northern or marsh shore westward of this resort.

Cross Breach Inlet and follow the direction of the railroad into and up *Conch Creek*. Take the left branch of Conch Creek to the canal

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which cuts off the southern loop of Sullivan Island Narrows; and, leaving the canal, continue through the narrows to The Cove. The passage through *The Cove* is marked by a black and a red beacon (white and red lights, respectively). Pass the black beacon on the starboard hand and hold down for the red beacon with two range marks in line astern; when nearly to it hold up for the drawbridge. Go through the northern opening in the drawbridge, leaving, on the port hand, a small spindle which marks a rock pile, 100 yards southeast of the southern abutment of the bridge. The passage out of The Cove is marked by a red beacon (red light) on the point of Sullivans Island, and by a white beacon (white light) on the shoal north of the channel. Leave the latter on the starboard hand. The distance from the entrance to Dewees Creek to this beacon is about 10 miles, and the depth is 4 feet.

From the last beacon steer about 275° true (**W ½ N** mag.) and pass through *Folly Island Channel*, leaving the black buoys on the port hand and Castle Pinckney (buoy depot) red light on the starboard hand.

If intending to stop at Charleston, hold up for the wharves on the west bank of Cooper River, leaving the red buoys on the starboard hand; but to continue southward by the inside route, when abreast of Castle Pinckney light, steer 210° true (**SSW ¾ W** mag.) to the horizontally striped buoy southward of Charleston, and then go up Ashley River to Wappoo Creek. The distance from The Cove entrance beacon to Charleston is 3 miles and to Wappoo Creek 4½ miles.

Charleston is situated on the point of land at the junction of Cooper and Ashley Rivers, and has water front and wharves on each; but the wharves on Cooper River are more convenient to the city. Yachts and small craft usually anchor in Cooper River below the coal wharf. There is a good landing for boats at the customhouse dock (the stone piers in front of the customhouse), where there are steps leading up from the water. Pilots for the inside waters can usually be had. Provisions, ship chandlery, coal, gasoline, and fresh water can be obtained. There is a marine railway for small vessels, and repairs can be made. Storm warnings are displayed from a tower in the customhouse yard and at *Moultrieville*.

CHARLESTON TO FERNANDINA.

Between Charleston and Fernandina there is a continuous inland waterway, navigable at low tide for a draft of 6 feet. Parts of this waterway are narrow and crooked, and only by careful steering can this depth be carried; but at the more difficult places there are ranges or other guides, and by close attention to them and to the charts one should have no difficulty in getting through. All of these

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entrance to Frederica River to a position favoring the east bank just northward of the next stream on that side, and then enter the river in midstream. The channel is narrow, and care is required in the southern part of Buttermilk Sound.

Keep in the middle of *Frederica River*, favoring if anything the outside of the bends, some of which are sharp. Great care is required at the sharp point about halfway through the river and lying ½ mile northwestward of Dunbar Creek. Follow the south bank on the north side of the point until approaching the bend, and then edge out to mid-channel to allow room for making the turn. Then haul sharply southeastward and follow the southwest side of the point at a distance of 150 feet until over 300 yards below the point to avoid a shell bank with little water over it.

Keep in midstream for 1½ miles past Dunbar Creek until the river begins to widen. Then follow the east bank at a distance of 150 yards until nearly down to the point opposite the broad opening to Mackay River, then gradually increase the distance from that bank in passing this opening, and follow the west bank at a distance of 150 yards to the next bend. Then follow the eastern bank to St. Simon Sound, leaving buoy No. 4 on the port hand and buoy No. 1 on the starboard hand. Then stand southward across St. Simon Sound to buoy No. 16, in the entrance of Brunswick River, and be guided by the ranges and buoys if desiring to stop at Brunswick.

Brunswick is on the left bank of Brunswick River, 7¼ miles above St. Simon lighthouse and 4½ miles off the track of the inside passage southward. It is an important shipping port, and has railroad connections with interior and seacoast cities and steamship connections with coast cities; river steamers connect with Fernandina and Darien.

There are extensive wharves, suitable for vessels of all sizes; and coal, water, gasoline, supplies, and ship chandlery can be had. There is one shipyard at which repairs to hulls and machinery can be made. It has one marine railway of about 300 tons capacity and a small railway for launches. Storm warnings are displayed from a tower in the city.

ST. SIMON SOUND TO ST. ANDREW SOUND, 8¾ MILES.—Leave buoy No. 16, in the mouth of Brunswick River, on the starboard hand and steer 215° true (**SW** by **S** mag.), keeping over 400 yards off the eastern shore until off the end of the stone jetty at the entrance of Jekyl Creek; this jetty is on the west side of the dredged channel into the creek and is marked at its end by a red buoy. Stand through the dredged channel on the *Jekyl Jetty range* (lights on pile structures), following the jetty at a distance of 100 feet, pass 200 feet northeastward of the front light, and stand through the narrow part of the

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creek in midstream until range beacons No. 3 (triangular targets) are in line astern. Hold this range until range beacons No. 2 (triangular targets) are in line ahead, and then stand on this range until beacons No. 1 (square targets) are in line astern. Hold the last range to the middle of the creek. The dredged channels, marked by these range beacons, have a depth of 7 feet or more, and lead between flats that are partly bare at low water; a training wall, partly covered at high water, lies westward of the northern part of the dredged channel.

Then keep near midstream for ½ mile until abreast the wharves and settlement on the east side, and then follow the east bank to Jekyl Sound. Then follow the eastern shore at a distance of 300 yards to St. Andrew Sound, at the south end of Jekyl Island. Then cross St. Andrew Sound, courses 146° true (**SE ⅞ S** mag.), for 1¾ miles to a position eastward of *St. Andrew Sound light* (pile structure in the mouth of the sound), and then southward to pass westward of the wooded north end of Little Cumberland Island, marked by a lighthouse.

ST. ANDREW SOUND TO CUMBERLAND SOUND, 20½ MILES.—Passing about 300 yards off the west side of the north end of Little Cumberland Island, steer about 207° true (**SSW ⅜ W** mag.), pass about 300 yards off the point of marsh on the west side of *Cumberland River*, and then steer about 217° true (**SW ¾ S** mag.) so as to pass 200 to 300 yards off the marsh on the east side southward of Cumberland High-point (High Bluff) and landing. Follow the east bank at this distance until abreast the point of woods on that side, and then cross the entrance of Brickhill River on a 243° true (**SW by W ½ W** mag.) course to a position 150 to 200 yards from the east bank. Then cross to the west bank northeastward of Shellbine Creek.

Follow the west bank keeping about 150 yards off until past the creek, then about 200 yards until this bank bends westward, then about 100 yards in rounding the point, 200 yards at the head of the bight, and then about 100 yards until off the mouth of the creek ½ mile southward of Cabin Bluff wharf.

Then cross to the east bank and follow it at a distance of 150 yards, drawing in to 100 yards when passing the middle ground, bare at low water. When abreast a grassy islet near the west bank, head over for the west bank just northward of Delaroche Creek, and follow that side at a distance of 100 yards for about ⅜ mile. Then cross over gradually to the east bank about ½ mile farther down, and follow it at a distance of 200 feet until abreast the north end of a marshy island.

Three range beacons, the front one being common to both ranges, will then be seen on the east bank southward of the opening into

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Brickhill River. Follow the eastern bank until the first range (triangular targets, No. 2) closes, and then keep this range until 200 feet from the east bank. Then follow this bank at this distance until range No. 1 (square targets) is nearly closed, and then keep a very little westward of this range until down to an islet which is left on the port hand. Then hold the range astern until approaching an islet which is left on the starboard hand, and then keep southward of the range. Pass 400 feet eastward of the islet and steer 213° true (SSW ⅞ W mag.) until about 150 yards from the west bank.

Then bring the edge of the marsh on this side astern on a 180° true (S ⅛ E mag.) course and cross to the west side of the large island on the east side of *Cumberland Sound*, which is passed at a distance of about 125 yards. Then steer 175° true (S ½ E mag.) and follow the western side of the next long, low, grassy island at a distance of 100 to 150 yards. A smaller island will be seen ahead; follow its west side at a distance of 100 yards until abreast its middle, and then steer 187° true (S ⅝ W mag.) to a position 200 yards eastward of the north end of a small island.

Stand southward to a position about 250 yards eastward of the middle of the island, and steer 158° true (SSE mag.) and then 141° true (SE ½ S mag.), following the eastern shore of Cumberland Sound at a distance of ¼ mile. The last course will lead to the horizontally striped buoy at the entrance to Amelia River, from which stand southward following the eastern bank to Fernandina.

Fernandina is on the east bank of Amelia River, 2 miles southward of Cumberland Sound. It is a shipping port for lumber and naval stores and is connected by steamboat with Brunswick and St. Marys. One railroad enters the city. The wharves extend for about a mile along the river bank and have deep water up to them. Coal, fresh water, and gasoline can be had at the wharves; gasoline is received from tank wagons. Provisions and some ship supplies can be had here. There are no facilities for making repairs to vessels. Storm warnings are displayed from a tower in the post office yard.

CUMBERLAND SOUND TO ST. JOHNS RIVER.

The inside passage between Fernandina and St. Johns River is in places shallow and difficult to follow. The channel, at the worst places, is marked by stakes and range beacons; but these are insufficient in number to guide a stranger past all difficulties. Through Sister Creek, the shallowest section of this passage, a draft of 3 feet can be carried at mean low tide; but the channel here is very narrow and crooked, and 5 feet is about the deepest draft that can be taken through safely. A stranger should attempt this passage only on a rising tide and preferably on the first of the flood, as the channel is easier traced then. The bottom is soft except at a few oyster beds.

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The average rise and fall of tides is from 3 to 6 feet, depending upon the place. With favorable weather and sea, better progress can be made by going outside from Cumberland Sound to St. Johns River, a distance of about 25 miles.

From the horizontally striped buoy in Cumberland Sound, enter *Amelia River*, southward of the buoy, and follow the eastern bank past the city of Fernandina. Then haul westward, keeping about in mid-river, and round the bend to southward. Pass one creek on the port hand, one on the starboard, and enter *Kingsleys Creek*, the second creek on the port hand. A railroad bridge and, 100 yards or so south of it, a highway bridge, cross Kingsleys Creek; both have draw openings of sufficient width for any craft able to take this passage. Kingsleys Creek enters South Amelia River ¼ mile below the highway bridge; and from here southward for 2 miles a narrow channel winds through shoals and marsh islets, covered at high tide.

Entering *South Amelia River* from Kingsleys Creek, look for channel stakes, as these, at high water, are the only guides to the channel, and leave them on the side indicated by the finger boards. Pass a small islet, submerged at high tide, and a stake close-to on the starboard hand, and turn slowly westward to pass an islet close-to on the port hand. Continue over to the western shore, just north of a wide opening; then, turning slowly to southeastward and eastward, pass several islets and a stake, on the starboard hand; then southward past two stakes on the port hand. From the last stake hold southward to the marsh on the starboard hand, and follow it to a small settlement on the eastern shore. Then follow the left bank southward, past a small creek, and westward to the turn. Cross over to the right bank here and follow it to the next bend, at which there is a stake.

Favor the left bank below there until nearly to the mouth of the creek, and then the right bank to its end in *Nassau Sound*. A shoal extends ¼ mile southeast from this point. When clear of this shoal, hold down the sound in mid-channel for a distance of 1 mile below the point. Then follow the western shore at a distance of 200 yards, watching out for the middle ground shoal on the port hand, and pass the entrance to *Sawpit Creek*, 1½ miles below South Amelia River, keeping 500 yards off the shore south of the creek until that distance below the entrance. Then haul in for the shore and follow it northwestward into Sawpit Creek.

Keep about in midstream for nearly 3 miles up Sawpit Creek, and then look for two range beacons, each a white, square target with black circle in center, on the eastern bank. Hold these beacons in line until the next range, marked by similar beacons on the northern bank, is nearly closed; then haul southward for *Gunnisons Cut* and keep the latter beacons in line until through the cut and the creek

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bends eastward. Then hold to midstream for about 700 yards until two slatted beacons on the western bank are in line; then steer by this range, passing close to the marsh on the starboard hand.

Below this range the best water is indicated by stakes with white finger boards, which should be passed close-to. Keep about in midstream, except at these stakes, turning first to southwestward from the range, then eastward, then southward, past an opening on the port hand, to a place where one passage runs southward and another eastward. Take the latter, past an opening on the port hand, and keep to starboard, past another opening on the same side, to Fort George River, which trends southeastward to the inlet of that name.

Pass this river, following the direction of the western bank into *Sister Creek*, and keep in midstream down past the woods on the western side to a small stream on the same side, a mile below the woods. There is a stake on the bank just east of the entrance to this stream, and another on the opposite bank, a little downstream from the former. Pass close to the mouth of this stream and 25 feet from the bank at the first stake; and then head over for the second stake, 81° true (**E** ⅞ **N** mag.) from the former, leaving a shoal on each side, and approaching the left bank within 25 feet.

Follow this bank to the next bend, and then the right bank, below the bend, at a distance of 20 feet, to a stake, passing west of a midchannel shoal. Favor the right bank for 1½ miles, past three openings in the left bank. Then hold to the right bank, at a distance of 10 feet, past two stakes 400 feet apart, and, at the second stake, cross to the left bank, past a wide opening on the port hand. Follow this bank, at a distance of 20 feet, around the bend, and then keep about in midstream for ½ mile, past an opening in the left bank and around two bends.

After rounding the last bend (where the creek trends southward again) some old buildings will be seen on the right bank; and just above them is the shallowest and most difficult place along this route. Favor the right bank until nearly abreast of a small opening in this bank, just north of the buildings; then keep close under the left bank until past this opening. Here oyster rocks extend nearly across from the right bank and are sometimes indicated by ripples; there is a strong current here at times. After passing this shoal haul sharply over to the right bank, to avoid another shoal on the left side, just below the former. Favor the right bank past the buildings and then cross over to the left bank, leaving the point here, at the entrance to a slough, at a distance of about 25 feet.

Cross the mouth of this slough, steering so as to be 25 feet off the left bank of Sister Creek when about 300 yards from the point below. Follow this bank down, gradually increasing this distance to 100 feet at the point, and, rounding the point, hold southward 100 feet from

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the bank until on the range for entering St. Johns River. The beacons for this range are square, white targets with circular black centers, mounted on piles on the left bank of Sister Creek. When on this range, steer 181° true (S mag.) on it into St. Johns River.

The distance from the horizontally striped buoy in Cumberland Sound to St. Johns River, by the inside route, is about 28 miles.

Mayport is on the south bank of St. Johns River, 1½ miles below Sister Creek and ½ mile above St. Johns River lighthouse. Storm warnings are displayed from a tower visible from the river. There is daily communication with Jacksonville by railroad and by river steamboat. Coal and fresh water can be obtained at the railroad wharf. Gasoline can be had in small quantities. Small craft can find protected berths on the inshore side of the railroad wharf; mooring at the other wharves is forbidden. There is a good place to beach a small craft just below the lowest wharf; the bottom is hard sand and smooth but so steep that boats should lie parallel with the shore; the average rise and fall of tides is 4.2 feet.

Jacksonville is on the north bank of St. Johns River, about 23 miles above the ends of the jetties. Extensive wharves extend along the north bank and are convenient for large and small vessels. Coal, gasoline, and fresh water can be taken conveniently at the wharves. Provisions and ship chandlery of all kinds are obtainable. The facilities for making repairs to hulls and machinery are excellent, and there are marine railways for hauling out large vessels.

Pilots for the inland waters can be had here and at Mayport.

ST. JOHNS RIVER TO KEY BISCAYNE BAY.

From St. Johns River to Miami, on Key Biscayne Bay, there is a continuous inside waterway through canals and natural channels, in which the controlling depths vary from 3 to 7 feet; but power boats, drawing 4 feet and even a little over, are able, under favorable conditions, to drag through the very soft bottom at the shallowest places.

These waters are nontidal, except in the vicinity of the inlets, but are affected to a considerable extent by strong northerly and southerly winds, which may alter the surface level as much as 2 feet in places. Some boats, to avoid the shallow water of Halifax River, go out at St. Johns River or at St. Augustine Inlet and coast as far as Mosquito Inlet, below which the least depth inside is 4 feet. A stranger should have but little difficulty in taking through a draft up to 3 feet, except, perhaps, at a few shallow places; but, for a greater draft, he should employ a pilot over parts of the route at least. Pilots for the whole distance can be had at Jacksonville and Mayport, and local pilots at many other places along the route. Supplies, fresh water, and gasoline can be obtained at convenient

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distances, and repairs can be made at several places along the route; but coal is scarce between St. Augustine and Miami and can be had only by arrangement with the Florida East Coast Railroad.

The inland waters are well marked by channel stakes as far south as Jupiter Inlet, but below this there are few Government marks until one gets to Miami. The usual type of channel stake is a palmetto pile with red or black finger board and number; but some are iron pipes with finger boards painted but not numbered. Going south, the black boards and odd numbers are left to port and the red and even numbers to starboard. Except where otherwise stated hereafter, the stakes are passed close-to on the side indicated as above. Some of the red boards have changed by weathering or otherwise until they appear white. Besides the Government stakes described above and south of Jupiter Inlet, where there are very few Government stakes, there are privately established marks, consisting of a pile or stake with a finger board pointing to the best water. These boards may or may not be colored, but generally are white, regardless of the side of the channel which they mark.

ST. JOHNS RIVER TO ST. AUGUSTINE INLET, 34 MILES, LEAST DEPTH 5½ FEET.—The approach to the canal leading to the inside waterways south of St. Johns River is by way of *Chicopit Bay*, which is reached by passing inside of the training wall at Great Marsh Island, about south of Sister Creek. The front beacon of the lower Mile Point Cut range stands on the shore of Great Marsh Island, west of the end of this training wall. Pass between the training wall and Great Marsh Island and keep close to the training wall until opposite the east end of the little island southeast of Great Marsh Island; then cross to the little island and follow closely its northern shore westward. Round the western end of the little island and haul eastward to the entrance to the canal. Distance from river 1½ miles.

This canal extends southward, nearly parallel to the coast, for about 17 miles to Tolomato or North River; it is 50 feet wide on the bottom and at least 5½ feet deep at mean low tide. Beginning in Chicopit Bay, near the mouth of *Pablo Creek*, it follows, in general, the old creek bed for about 8 miles, but leaves the creek frequently to cut across wide bends in the old bed. A highway bridge crosses the canal about 3 miles below Chicopit Bay and a railroad bridge about 2½ miles farther down; both have draw openings of ample width. After leaving the old creek bed the canal cuts through high wooded ground for about 7 miles and then for 2 miles through marsh, and extends in a series of long straight reaches connected by easy curves. The southern entrance is easily recognized by dry sand banks on each side. There are no channel stakes in the canal, and in the northern section, at the places where it crosses Pablo Creek,

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one may be in doubt as to which course to take; the only guide here is the evidence of dredging on the canal banks. Tidal currents amounting to 2 knots are encountered at the railroad bridge; they set north with ebb tide.

The *Tolomato* or *North River* flows southward 14 miles from the canal mouth to St. Augustine Inlet, and varies in depth from 5½ to 30 feet at low tide. The channel is sufficiently marked by stakes for a distance of 3½ miles below the canal. From stake No. 16 (red), favor the right bank to a little islet on that side, 1 mile below No. 16; then keep close to the marsh on the port hand nearly to stake No. 9 (black). After rounding the bend below stake No. 15 (black), keep in midstream to the next bend below; keep close to the right bank throughout this bend; and then, when the river turns southward again, hold to the left bank for 1 mile. There is a light (No. 20) at the mouth of the river, and there are stakes showing the channel to St. Augustine.

St. Augustine Inlet is used to a considerable extent by yachts bound for St. Augustine; it is marked by St. Augustine lighthouse and a wireless telegraph station on the southern side of the entrance. The channel is marked by small buoys and by a perpendicularly striped sea buoy, "St. A," which are shifted to conform to the best water. Licensed pilots are stationed at the city of St. Augustine and will come out to a vessel in answer to a signal; but the usual practice is to telegraph ahead from the last port. The bar and channel are said to shift frequently and to be impassable during fresh easterly winds. In April, 1912, the depth on the bar at mean low tide was 5 feet. At that time the channel ran in 248° true (**WSW** mag.) for the wireless telegraph pole farthest north of the lighthouse, past a red nun buoy, and there turned and followed the southern shoal into the inlet.

The average rise and fall of tides is 4.5 feet; and high and low waters occur 8 and 19 minutes, respectively, before high and low at Charleston, S. C.

St. Augustine is a popular winter resort for tourists and yachtsmen, and has several fine hotels open during the winter season. A railroad connects with Jacksonville, and there are biweekly connections by steamboat through the inside waters; a power boat runs to Daytona three times a week during the tourist season. The channels to St. Augustine from the sea and through the inside waters are well marked by buoys and stakes and present no difficulties for a draft of 6 feet. There is good anchorage abreast of the city in the Matanzas River, both above and below the bridge, through which there is a wide draw. The wharves north of the bridge have depths of about 10 feet across the ends; and most of them are piped for fresh water. The first wharf south of the bridge, a recreation pier, has a depth of

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7 feet at its end; but the wharves south of it are in shallow water. Provisions, some yacht supplies, coal, gasoline, and fresh water can be had here. There are facilities for making minor repairs to hulls and machinery, and ways for hauling out craft of about 10 tons. Storm warnings are displayed from a tower at Fort Marion.

San Sebastian River flows past the west side of the city of St. Augustine and empties into Matanzas River 1½ miles south of the bridge. It is navigable for a draft of 7 feet as far as the highway bridge. Supplies may be taken at a wharf on this river on the west side of the city.

ST. AUGUSTINE INLET TO MOSQUITO INLET, 57 MILES, LEAST DEPTH 3 FEET.—*Matanzas River* trends southward from its junction with Tolomato River at St. Augustine Inlet, past the city of St. Augustine, for about 15 miles to Matanzas Inlet. The channel through the broader section of the river is very narrow and winds between shoals; but it is well marked by stakes and requires no directions.

Matanzas Inlet has a least depth of 5 feet on the bar at mean low tide; but the channel in the mouth of the inlet is obstructed by a ledge of rock, over which the depths vary from 2 to 9 feet. Strangers should not attempt to use this inlet.

A canal runs southward from Matanzas Inlet for 21½ miles to Halifax River and parallels, in general, the coast line. It varies in width from 60 to 100 feet at the water level, and is comparatively straight, except near the lower end. Where it traverses broader waters, the canal limits are shown clearly by banks of dredged material, often above the water level. A highway drawbridge crosses the canal 1½ miles north of Halifax River; it is not tended, and boatmen must open and close it themselves. Tidal currents are experienced for a distance of about 6 miles south of Matanzas Inlet; and below there a current usually sets southward regardless of the tide; it has a strength of about 1 knot. The least depth from St. Augustine to Halifax River is 5 feet; but the depth in the canal is affected to a considerable extent by strong northerly and southerly winds.

DIRECTIONS.—From the old fort on the western bank of Matanzas River, near Matanzas Inlet, keep close to the eastern shore nearly down to the inlet, and then cross over to the beacon in the southwest corner of the inlet. Leave this beacon 50 feet on the starboard hand and haul southwestward into the canal, taking care to avoid getting into the old channel which runs south. No further instructions are necessary until one gets to Halifax River; the lower part of Halifax Creek is marked by white handboards on the side of the best water.

Halifax River for 5 miles northward of Mosquito Inlet, into which it empties, is a narrow stream, winding through marshes; but northward of there for 15 miles it is a shallow lagoon, about ½ mile wide, separated from the ocean by a strip of wooded beach from ¼

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to ½ mile wide. A draft of 5 feet can be taken up to Daytona, about 10 miles above the inlet. The channel depth in the northern part of the river, for a distance of about 3 miles southward from Halifax Creek and Canal, varies from 3 to 4 feet; but the bottom to a depth of 6 feet is very soft mud, through which a power boat of 4¼ feet draft can drag. Six drawbridges cross the river. The mean rise and fall of the tides at the inlet is 2.3 feet and at Daytona about 0.7 foot; but river tides are influenced to a considerable extent by strong northerly and southerly winds.

Directions for Halifax River.—On leaving Halifax Creek, follow the line of piles for 3½ miles, leaving them all on the port hand at a distance of 20 to 30 feet. Then keep about 200 yards off the eastern shore, hauling in to 100 yards at the last boathouse on this shore; and when abreast of this boathouse, head for the draw in the Ormond bridge. After leaving this bridge steer to pass the stakes south of it at a distance of 15 feet on the port hand, and then bring them in line with the draw tender's house. Steer by this range until the next stakes, 1¼ miles northward of the next bridge, are picked up. Pass these stakes at a distance of 25 feet on the port hand and head for the draw in the next bridge. Pass through the third and fourth drawbridges and then haul slowly eastward for the fifth draw, which is near the eastern end of this bridge.

The channel to Daytona is south of this bridge; see description of Daytona. South of the fifth bridge favor the eastern shore, keeping at first 100 yards off and then gradually increasing the distance to 350 yards when below the next point on the western side. Haul in to 200 yards when 1 mile from the next bridge (Port Orange), and then be guided by the stakes to the bridge. Below this bridge the channel through the marsh is sufficiently marked by stakes to Ponce Park, on the eastern shore, 1 mile above Mosquito Inlet.

The distance from St. Augustine Inlet to Mosquito Inlet is about 57 miles.

Daytona is a popular winter resort on the western bank of Halifax River, about 9½ miles above Mosquito Inlet lighthouse. It is on the Florida East Coast Railroad and is connected during the tourist season with St. Augustine, Palm Beach, and intermediate points by large power boats carrying passengers and freight. Approach to Daytona is obstructed by a shoal from ½ to 2 feet deep, extending along the entire water front and out to the narrow river channel, which here is near the eastern shore. The wharves are reached by narrow channels which have been dredged through this shoal. The city wharf is about 30 yards southward of the fourth bridge and is reached by a narrow channel from 4 to 4½ feet deep, running parallel to the bridge from the main channel at the draw; the channel is marked by stakes on both sides. In April, 1912, there was a depth

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of 3½ feet along the southern side of this wharf and scarcely any water on the northern side; but there was a project on foot then to improve the water front by dredging a channel and basin deep enough for any craft able to get up here. The Halifax River Yacht Club is south of the city wharf and is reached by the same channel. Provisions, some yacht supplies, gasoline, and fresh water can be obtained here; water is piped to the end of the city wharf. The facilities for making repairs to hulls and to the machinery of power boats are good; and there are ways for hauling out craft up to 80 tons and 4½ feet draft.

The mean rise and fall of tides is about 0.7 foot.

Mosquito Inlet, from ½ to 1½ miles southward of Mosquito Inlet lighthouse, is used by small craft bound for New Smyrna and by yachts unable to get through the shallow waters of the upper Halifax River. A shifting bar extends about ¾ mile seaward, beyond which depths increase rapidly from 3 to 10 fathoms. The channel across the bar shifts position frequently, but maintains a depth of about 6½ feet at mean low tide; it is marked by a small red buoy and the approach by a perpendicularly striped sea buoy. Inside the inlet the channel branches, one part winding northward through shoals to Halifax River, and the other turning southward to Hillsborough River; both are deep (9 feet and over at low tide). A horizontally striped buoy marks the junction of the two channels; and buoys and a number of stakes mark the channel to Halifax River; the aids are shifted to conform to changes in the channel. A bar pilot lives at Ponce Park, near the lighthouse, and will come out to a vessel in answer to a signal, if it is seen; but the safest plan is to write or telegraph ahead for a pilot. The average rise and fall of tides is 2.3 feet; high water occurs 1 hour and 41 minutes before and low water 1 hour and 8 minutes before high and low at Old Point Comfort, Va.

New Smyrna is a winter resort on the western bank of Hillsborough River 3 miles from Mosquito Inlet. It is on the Florida East Coast Railroad and is a flag stop for boats of the inland waterways. The draft that can be carried to there is limited only by the depth on Mosquito Inlet Bar; the depth at the city wharf is 14 feet. This wharf, which is the first coming from the inlet and is nearly opposite the hotel, is piped for fresh water. Provisions and gasoline can be obtained here. Pilots for the inland water can be obtained here. There are strong tidal currents in the river abreast the city.

MOSQUITO INLET TO ST. LUCIE INLET, 129 MILES, LEAST DEPTH 4 FEET.—*Hillsborough River* winds southward about 15½ miles through the marshes to Mosquito Lagoon, and is a narrow, tortuous passage, requiring careful steering and close attention to the channel stakes. One drawbridge crosses the river, 1¾ miles above its mouth. A draft

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of 6 feet can be carried for a distance of 8 miles above the entrance; but for the next 3 miles a draft of 4 feet is all that can be taken through at low tide; and there are several places where a slight divergence from the best water will take one into depths of 3 feet. The mean rise and fall of tides here is said to be 1 foot and to occur about 3 hours later than at New Smyrna. The river is well marked by stakes, which are a sufficient guide for a draft of 3 feet; but for a greater draft a pilot should be taken.

DIRECTIONS.—From the mouth of Halifax River be guided by the stakes and buoys across Mosquito Inlet. Then follow the eastern bank of Hillsborough River to the drawbridge, keeping close to this bank. The channel is well marked from here up and requires directions only at a few places. After leaving red stake No. 6, 1½ miles above New Smyrna, the remains of an old wharf will be seen extending out from the western shore. There is a shoal in mid-channel just north of it; to avoid which, when abreast of the last island on the starboard hand, haul in to pass the outer pile at a distance of 50 feet. When up to stake No. 8, slow down and take the next 3 miles at very slow speed. Around the point beyond stake No. 16, known locally as Shipyard Point, the channel is very narrow and passes between two hard shoals. Stakes are sometimes down here, and then one must feel his way carefully with a sounding pole.

Mosquito Lagoon is a broad body of water from 1 to 10 feet deep, extending southward from Hillsborough River and connected with Indian River by a short canal, known as the Haulover. A draft of 4 feet can be carried through into the Indian River. The distance from Hillsborough River to the Haulover is about 10 miles. The entrance from Hillsborough River is marked by stakes and by narrow islets of dredged materials on each side of the cut; there is a pile with crossed boards, at the turn, and a pile, marking a rock, south of the channel.

Leave the beacon (crossed boards) on the port hand and steer 152° true (**SSE ½ E** mag.), parallel to the western shore at a distance of ½ mile, until down to the stakes, 2 miles from the Haulover. Then be guided by the stakes, but do not head in for the Haulover until the cut opens, bearing 220° true (**SW ½ S** mag.).

The *Haulover* is a canal ⅜ mile long through the strip of high, wooded land that separates Mosquito Lagoon from Indian River. Seen from westward (in Indian River) the cut appears first as a square notch in the foliage, but on near approach the canal is seen. Dredged channels, 4 feet deep, lead up to it at each end; but the land cut is 11 feet deep. The water level at the Haulover varies as much as 1½ feet from normal level under the influence of strong northerly or southerly winds; northerly winds lower the level here and in the northern part

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of the Indian River. At such times there is a current through the canal of as much as 3 knots, setting in the direction of the wind. On the southern side of the canal are the homes of several fishermen, and on the northern bank, at the entrance from Mosquito Lagoon, is the post office of *Allenhurst*, in front of which a wharf extends about 75 yards along the bank. Provisions, gasoline, and fresh water can be obtained here, and sometimes a pilot for the inland waters.

Indian River extends southward along the coast to St. Lucie Inlet, which, measured along the channel, is about 103 miles below the Haulover. It is, in general, a broad lagoon from 6 to 15 feet deep, although at one place (abreast Grant Island) it shoals to but little over 4 feet. At a distance of 63 miles below the Haulover the river is narrow and is nearly closed by shoals and small marshy islets, through which there is a clear, well-marked, but narrow channel of at least 6 feet depth.

The river is nontidal at a short distance above the inlet, but may vary in depth as much as 2 feet under the influence of strong northerly or southerly winds. The important towns are on the western bank, on the Florida East Coast Railroad, and are *Titusville*, 8½ miles; *Cocoa*, 24½ miles; *Eau Gallie*, 39 miles; *Fort Pierce*, 84 miles; and *Jenson*, 97 miles from the Haulover.

DIRECTIONS FOR INDIAN RIVER.—From the Haulover follow the channel stakes through the dredged channel and then steer 226° true (**SW** mag.) for 3 miles to a pile with crossed boards. Leave this on the starboard hand and steer 181° true (**S** mag.), heading for Titusville. When 1 mile from the red stake off Titusville, haul out to leave it on the starboard hand at a distance of 100 to 200 yards, and, if bound for Titusville, hold down on this course until abreast of the wharf before heading in for it.

Titusville.—A depth of 5 feet can be carried to the end of the public wharf; but the shoal, marked by the red stake, extends nearly down to a line running eastward from the wharf. Provisions and gasoline can be had here. Titusville Pierhead light is on the south corner of the wharf.

From a position 200 yards east of the red stake off Titusville, steer 162° true (**S** by **E** ¾ **E** mag.) for about 5 miles to a position 200 yards east of the next stake on the same side; then 169° true (**S** by **E** mag.) for about 4 miles to a position 450 yards eastward of the next stake; then 167° true (**S** by **E** ¼ **E** mag.) for 5¼ miles to a stake on the same side, off Magnolia Point; and then 161° true (**S** by **E** ¾ **E** mag.) for 1⅝ miles to position abreast of Cocoa.

Cocoa.—A depth of 6 feet can be taken to the city wharf, which is the most northern of the several wharves. Provisions, some yacht supplies, and gasoline can be had here. There are small repair shops but no marine railway.

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From the last position continue this course for 1¼ miles, or from 200 yards off the wharves at Cocoa, steer 153° true (**SSE ½ E** mag.), to a position 200 yards west of the stake opposite Rock Ledge. Then steer 157° true (**SSE ⅛ E** mag.) for 10 miles, past one stake (close to) on the port hand; and then, to go to Eau Gallie, steer 167° true (**S by E ¼ E** mag.) for 3¼ miles to the wharves.

Eau Gallie.—A depth of 4½ feet can be taken to the railroad wharf. Gasoline and provisions can be had here. A draft of 3 feet can be taken into Elbow Creek to a place where water can be had; but the channel into the creek is narrow. The entrance to Elbow Creek is marked by a light on the northern side, and the channel in the creek is marked by stakes.

From a position ½ mile eastward of Eau Gallie, steer 157° true (**SSE ⅛ E** mag.) for 7 miles, passing a black stake on the port hand at a distance of 350 yards; and then haul eastward a little to pass the next red stake at a distance of 200 yards on the starboard hand. From this stake steer 161° true (**S by E ¾ E** mag.) for 4 miles and then haul eastward for black beacon No. 7. Then be guided by the channel stakes along the dredged channel westward of Grant Island, disregarding entirely the old red beacon northwestward of this island.

There is an old boiler, the remains of a wreck, on the western side of the channel, about 1¼ miles southward of Grant Island. Leave this boiler about 200 yards on the starboard hand and the stake below it about 100 yards on the same side. Then steer 154° true (**SSE ⅜ E** mag.) for 8¼ miles, keeping about ½ mile from the western shore to Barkers Bluff, which is a prominent white sand bank on this shore, 3¾ miles below Sebastian Creek, and passing the islets on the port side below the bluff at a distance of 300 yards. When nearly down to the black beacon on the port hand, steer to pass it at a distance of 100 yards, heading for the outer end of the wharf at Orchid (on the same side). The channel through the Narrows is sufficiently marked by stakes, which are left close aboard in passing. South of the Narrows, the channel as far as Fort Pierce is very narrow, and in places is dredged through shoals, but is sufficiently marked by stakes.

Fort Pierce.—The longest wharf has depths of 5 to 6 feet at the outer end and along its northern side; and 5 feet can be taken to it. It is piped to the outer end for fresh water. Provisions, some yacht supplies, and gasoline can be had here. There are facilities for making minor repairs to hulls and machinery, but no means for hauling out vessels; small boats are hoisted in slings.

Indian River Inlet, 3 miles above Fort Pierce, is nearly closed at present, and is used only by small fishing boats at high water.

Southward of Fort Pierce the river channel is broader and deeper. Keep ½ mile from the western shore nearly to beacon No. 17 (black), ⅜ mile from shore in passing this beacon, and then about ½ mile off

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to the next stake (red), north of Jensen. Southward from Jensen, keep ½ mile from the western shore until the stakes at Sewalls Point are picked up.

Jensen.—A depth of 4 feet can be carried to the outer wharf by steering square in for it, but there are shoals of 3 feet depth on each side of this channel. Provisions and gasoline can be had here. There is a small machine shop and a marine railway of about 10 tons capacity.

St. Lucie Inlet is the entrance from sea to St. Lucie and Indian Rivers and is used to some extent by yachts and fishing boats. The inlet and approach from seaward are partly closed by shoals, which shift with every storm. The channel depth on the bar is said to vary from 5 to 6 feet at low tide; and in April, 1912, there was a clear channel, 5 feet deep and over, from the bar to both rivers. There are no buoys or other marks from seaward; and directions, on account of frequent changes, would be useless. There are no regular pilots stationed here, but sometimes a fisherman can be engaged to bring in a vessel. A stranger should not attempt to enter this inlet. The mean rise and fall of tides is about 1.5 feet. A channel, well marked by stakes, crosses the head of the inlet from Indian River, past Sewalls Point and the mouth of St. Lucie River, to Great Pocket, on the south side.

ST. LUCIE INLET TO JUPITER INLET, 15 MILES, LEAST DEPTH 4 FEET.—The older route southward from St. Lucie Inlet was through the arm eastward of Long Point to North Jupiter Narrows, but recently a canal 35 feet wide and 5 feet deep has been cut through from the head of Great Pocket, on the western side of Long Point, to the head of Peck Lake, thus avoiding the shifting sands in the more exposed part of the inlet.

Cross St. Lucie Inlet, by the channel indicated by stakes, to a stake north of Long Point, a mangrove point separating two long lagoons south of the inlet; turn into the western lagoon (*Great Pocket*), passing the mangroves at a distance of about 100 feet, and steer for the head of this lagoon, about 158° true (**SSE** mag.). When nearly to the head of Great Pocket, several small stakes will be seen ahead, marking the sides of the dredged channel. A depth of 4 feet can be carried through to the canal and 5 feet and more through Peck Lake. Stakes mark the channel in Peck Lake leading from this canal and also the approach to South Jupiter Narrows, at the lower end of the lake.

South Jupiter Narrows is not difficult, but there are a few shallow places that must be avoided. Just north of the first opening in the eastern bank is a narrow shoal on the other side; 1¾ miles below there is a narrow dredged channel marked by a red stake, and below this bend the best water is along the western bank. A highway drawbridge crosses the stream near its lower end.

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Hobe Sound and *Jupiter Sound* are small bodies of water but little over ¼ mile wide at the broadest part. The channels through both are well marked by stakes, and careful attention should be given to them, as the bottom in many places is hard sand or rock. At Conch Bar, which joins the two sounds, careful steering is necessary when passing stakes Nos. 38 and 40, as there is a hard shoal close to the western side of the channel.

Jupiter Inlet is obstructed by a sand bar, which shifts with every storm and at one time entirely closed the mouth of the inlet. In April, 1912, there was 4 feet on the bar and 2½ feet inside the mouth of the inlet. It is used only by small local boats at high tide. A lighthouse and radio station are on the northern shore of Jupiter River, about 1 mile above the inlet. The river is shallow eastward of the entrance to Jupiter Sound and nearly to the western side of that entrance, but there is a narrow channel close under the point, on which there is a stake. An oyster bar fills the river west of the lighthouse, except for a narrow dredged cut, which is marked on each side by stakes. The average rise and fall of tides at the inlet is 1½ feet.

JUPITER INLET TO NEW RIVER INLET, 52 MILES, LEAST DEPTH 4 FEET.—Lake Worth Creek and Canal together are about 8 miles long and connect Jupiter River (near the inlet) with Lake Worth. For a distance of about 3 miles the canal follows the old creek bed in places but frequently cuts across bends and intersects many sections of the old creek. Below there the canal extends in a series of straight reaches connected by easy curves. The controlling depth is 4 feet; but in many places the banks have caved, and power boats, getting aground, have thrown up shoals which are difficult to avoid. Tidal currents of 1 knot strength may be found in the canal, and probably there is a rise and fall of from 6 inches to 1 foot.

From Jupiter River, abreast the lighthouse, follow the direction of the stakes through the oyster shoal and to the point at the west end of the south shore. Round this point and follow the shore on the port hand until into Lake Worth Creek. The only guide for the next 3 miles will be the evidence of dredging, as shown by low, vegetation-covered mounds on the banks of the canal; there are few if any stakes. Go very slowly, keeping in general to the outer side of the bends and watching out for shoals. After reaching the straight stretches no difficulties will be found.

Lake Worth extends 18 miles southward from the canal entrance, which is ¾ mile from the head of the lake and is separated from the ocean by a strip of beach but 200 yards wide at places. The lake varies in width from ½ to 1 mile and in channel depth from 4½ to 11 feet. The entrance to the canal leading northward is recognized

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at a distance of over a mile by a white sand ridge at its mouth, and the approaches to this canal and to the canal leading out of the south end of the lake are marked by small stakes. The average rise and fall of tides is said to be from 3 to 6 inches, but the lake is said to have risen 3 feet during a storm.

Lake Worth Inlet cuts through the beach about 3 miles below the northern end of Lake Worth and affords the only direct connection with the ocean. Boats of 3 feet draft can get through on high tide; the depth on the outer bar is about 1 foot greater than over shoals in Lake Worth. The inlet is used to some extent by fishermen and by small pleasure boats, but should not be attempted by a stranger.

West Palm Beach is a small city on the west shore of Lake Worth, 7 miles below the northern entrance canal and on the Florida East Coast Railroad. It is connected by railroad and highway bridges and by ferry with the fashionable winter resort of Palm Beach, which is due east from it (between Lake Worth and the ocean). A line of large light-draft power boats ply between West Palm Beach and Daytona through inland waterways stopping at all the important intermediate towns. Depths of 3 to 5 feet can be taken to the various wharves, and a depth of 4 feet to the city wharf, which is just south of the city park. Provisions, gasoline, and fresh water can be had. Repairs to hulls and machinery of launches can be made at West Palm Beach and at Lone Cabbage Island, 1 mile south of the city. At the latter place there is a marine railway said to haul out vessels up to 100 tons and 4 feet draft. Storm warnings are displayed from a tower in the city park.

DIRECTIONS FOR LAKE WORTH.—On leaving the canal at the northern end of the lake be guided by the stakes until clear of the last, and then steer to pass the south end of the island at about one third the distance to the western shore. Then steer 181° true (S mag.) until the first stake is picked up (a pipe surmounted by a white can), leaving it on the starboard hand. Leave the next stake on the port hand, and then haul in slowly for the east shore; follow this shore at a distance of 150 yards nearly to the drawbridge. After passing the first draw keep to the eastern side until abreast of the wharves at West Palm Beach. South of the second drawbridge keep about 150 yards west of the rocks and islets on the east side for 4 miles, and then favor a little the west side to the canal at the south end of the lake. As the south end of the lake is approached the canal will be recognized by the notch in the foliage; steer for it and keep the notch open.

This canal extends southward from Lake Worth about 13½ miles to *Hillsboro River*, crossing three small ponds, the largest of which are called Lake Wyman and Lake Boca Raton. From the junction with Hillsboro River the canal cuts across two bends and then follows

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the direction of the old river bed to Hillsboro Inlet, 3¼ miles below the first crossing. The canal between the lake and river presents no difficulties, although at places it is quite crooked; through Lake Wyman the channel is indicated by clumps of mangrove on each side. A drawbridge crosses the canal about ½ mile from Lake Worth and another about 4 miles farther south; both are tended. In the wider part of Hillsboro River a channel has been dredged along the western side, leaving a submerged ridge along the center. The least channel depth found in the river and canal was 4½ feet; the bottom and sides are hard sand and rock.

Entering Lake Boca Raton from the north, turn sharply southward and follow the western shore until the canal opens. At Hillsboro River hold southward through two short cuts to the old river bed, below a couple of eastward bends. Take the next bends at slow speed, turning carefully to keep the propeller clear of the rocky sides of the channel. When the river widens, about 1½ miles from the lighthouse, keep close to the west bank to avoid a shoal ridge in midstream, and follow this shore past a lagoon and to the next narrow opening on that side.

Hillsboro Inlet lighthouse stands on the north side of the entrance to *Hillsboro Inlet*, which is very shallow.

A canal and natural waterway extend about 9½ miles south to New River Inlet; the passage is about of the same class as that north of Hillsboro Inlet and is good for a draft of 4 feet. A highway drawbridge crosses about 2 miles below Hillsboro Inlet.

After leaving the straight canal at a little pond, about 6½ miles from Hillsboro Inlet, go slowly, keeping a sharp lookout for shoals. No directions can be given for avoiding them; but as the water is usually clear one can see them in time to sheer off if moving slowly. At the mouth of this stream (marked on the east side by a small private stake) haul slowly eastward, keeping about in midchannel until past the mangrove point on the west side and then close to the east shore. Leave the little islet on the starboard hand and then haul off a little to avoid a shoal on the east side. Below this shoal keep close to the east side down to abreast of the house of refuge, on the north side of New River Inlet.

New River Inlet is 9 miles south of Hillsboro Inlet and lighthouse (measured along the seacoast) and is the only break in this coast between this lighthouse and the new entrance to Miami. The inlet is used by small local boats and by a few light-draft yachts, but is too shallow to be of any importance. In April, 1912, the least channel depth on the bar was 3½ feet and over the inside swash 2½ feet, at mean low tide. The average rise and fall of tides is about 1½ feet. Strangers should not attempt to enter; and there are no pilots near the inlet. Three branches of New River meet at the inlet; one from

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the north; one from the south, close under the coast and separated from the ocean by a very narrow strip of sand that is submerged near the inlet on high tide; and the third from the west. The western branch varies in depth from 5 feet at its mouth to 40 feet at Fort Lauderdale, 1¾ miles above the inlet.

The river is said to be deep for a distance of 7 miles above Fort Lauderdale to the south drainage canal, which joins the canal from the Miami River to Lake Okeechobee. The north drainage canal enters this river about 1 mile above Fort Lauderdale and runs direct to the lake. A depth of 6 feet can be taken from Fort Lauderdale through the drainage canal to *Lake Okeechobee*, and thence 3 to 4½ feet (depending on the rainfall) through canals and lakes to the headwaters of *Caloosahatchee River*, and down the latter stream to *Fort Myers* and the Gulf of Mexico.

Fort Lauderdale is a small produce-shipping station on the railroad. Provisions, gasoline, and fresh water can be obtained here. There is a repair shop for power boats, and a marine railway of 30 tons capacity Drawbridges cross the river above and below the town.

NEW RIVER INLET TO MIAMI, 23 MILES.—From a position close to the east shore of the inlet abreast the house of refuge, cross over to the point on the south side of the inlet, watching out for shallow water on the starboard hand. Then steer to pass northward of the small islets west of this point. To go to Fort Lauderdale, continue along the north shore into the western branch and then mid-channel up this river. To go south, take the second opening between the islets on the port hand (just above this opening is a small clump of mangroves in the river) and steer 181° true (S mag.) for the eastern shore of the lagoon. Follow this shore at a distance of 50 to 100 feet to a well-defined mangrove point. Pass this point at a distance of 50 feet and then haul off a little and continue at a distance of 100 to 150 yards from the eastern shore. Near the lower end of this passage a narrow channel has been dredged, leaving shoals on each side. A stake, if in place, marks the west side of this cut.

At the lower end of this passage is a small circular lagoon, known as *Lake Mabel*. A draft of 3 feet can be carried through at low tide, and there is a rise and fall of about 1½ feet. From the cut and stake, referred to above, steer to pass the east side of the entrance to Lake Mabel at a distance of 50 to 100 yards, and then haul slowly eastward until the canal out of the side of the lake bears 91° true (E mag.). Shallow water will be passed on both sides until the canal is reached. There are strong tidal currents in this canal, especially on ebb tide, when the current sets eastward.

New River Toll Chain.—From the short canal out of Lake Mabel the route is south, through the south branch of New River, for 1¾ miles to the entrance of the last canal on this coast. Just inside the mouth

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of this canal a chain stretches across from shore to shore and prevents passage until toll is collected. Toll is at the rate of 10 cents per foot of length for passage one way; and payment of 1½ tolls entitles one to free passage returning. The toll keeper's house is on the west bank of New River, on the north side of the canal. The mean rise and fall of tides here is said to be 2½ feet, and there are tidal currents of 2 knots strength.

The canal is nearly straight for about 7 miles to Dumfounding Bay and has an average surface width of 40 feet and depth of 4 feet and over at low water. About 1 mile southward from the toll chain a small canal from Dania enters this canal through its western bank.

Small private stakes mark the passage across *Dumfounding Bay*. The direction across to the southern outlet is about 209° true (**SSW ½ W** mag.). The passage south of Dumfounding Bay is very crooked and requires careful steering to avoid the shoals at the bends. A few private stakes mark the crossing of Snake Creek. Turn sharply to eastward when this creek is reached; then to southward. A little farther down there are two branches; take the western branch. There are sometimes tidal currents of ½ to 1 knot in this creek. This creek enters the head of Key Biscayne Bay through two mouths, close together; the western is preferable.

DIRECTIONS FOR THE NORTH END OF KEY BISCAYNE BAY.—At the mouth of the creek keep close to the bushes on the port hand, to avoid a shoal south of the creek, until nearly abreast of a stake. Then haul southward, passing this stake close-to on the starboard hand and the islet on the port hand. Steer for the stakes leading out of this arm, passing them close-to on the port hand, as the channel through here is narrow. At the third stake below the islet turn sharply westward for a stake close to the mangroves and north of a little creek on the west side. Leave all stakes on the port hand, except where two stakes close together indicate that the channel is between them. The channel is not over 100 yards from the western shore after crossing over from the third stake.

From the last stake in this part of the bay (third below the double stakes and 1½ miles below the little creek referred to above) steer 175° true (**S ½ E** mag.) until a small red beacon is picked up, and then steer for it. This beacon marks the northern end of a 5-foot cut through a shoal that extends completely across the bay. Leave this beacon close-to on the port hand and steer for the Royal Palm Hotel, the most prominent building on the eastern side of Miami. The eastern side of the cut is marked by several small stakes and a small white beacon at its lower end. Pass all close-to on the port hand and continue on this course for a distance of ¾ mile past the white beacon; then steer 181° true (**S** mag.) for ½ mile, and then steer for the hotel again.

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The distance from New River Inlet to Miami is about 23 miles.

Miami is on the west shore of Key Biscayne Bay, 9 miles below its head and 7 miles above Cape Florida. It has some commercial importance and is becoming a popular winter resort. It is on the Florida East Coast Railroad, which extends across the keys to Key West. Provisions, ship chandlery, coal, gasoline, and fresh water can be obtained here. There are good facilities for repairing hulls and machinery of small craft and several small marine railways, at the largest of which 120 tons can be hauled. Storm warnings are displayed from a tower on the water front near Twelfth Street and are visible from the bay.

Vessels up to 10 feet draft can come to the railroad wharf at Miami through a channel between the shoals south of Cape Florida to Key Biscayne Bay, thence up the bay to a dredged channel leading to the wharf. This channel is well marked by beacons and buoys. For directions see Key Biscayne Bay on page 116.

The bay in front of and just south of Miami is very shallow, except where channels have been dredged. One channel leads from the deeper water south of the city to a turning basin at the railroad wharf and another from a new cut north of Norris Cut; both are marked by piles and beacons. A narrow channel, 5 feet deep, leads along the water front, past the ends of the small wharves to the Miami River.

Small craft usually anchor off the city just north of Twelfth Street and east of the channels in 6 or 7 feet of water or go to a wharf. Large vessels must go to the railroad wharf or anchor below the shoals, 3 miles south of the city. Vessels of 6 or 7 feet draft can go to any of the wharves in Miami River below the bridge, and 4 feet can be taken to the wharf at Twelfth Street. There is no city wharf, but boats may lie at the Twelfth Street or Royal Palm Wharves for a small charge.

The mean rise and fall of tides at Miami is 1.1 feet.

Miami River trends westward, through the southern part of the city of Miami, to the Everglades and is navigable for a draft of 6 feet to the drainage canal, about 3 miles above its mouth. Three drawbridges cross the river, to the lowest of which a draft of 8 feet can be carried. To enter the river from the main ship channel, bring the eastern wing of the Royal Palm Hotel to bear 336° true (**NNW ¼ W** mag.) and steer for it until the river opens fair.

FROM MIAMI TO KEY WEST.

The passage inside the reefs east and south of the Florida Keys from Fowey Rocks, at the entrance to Miami, to Key West is known as Hawk Channel. It is navigable for a draft of 10 feet and is well marked by beacons and buoys. The passage is protected, except at

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a few places, by offshore reefs, and is comparatively smooth in ordinary weather. The distance from Miami to Key West by this channel is about 136 miles.

Vessels drawing less than 5 feet can go west and north of the keys to Bahia Honda Harbor, and from there, either through Hawk Channel or by way of the Gulf, to Key West. This route is through smooth waters, and is well suited to small craft. It leads through a series of small sounds and protected bays from 6 to 10 feet deep, separated by coral reefs, through which narrow channels have been cut to a depth of 5 feet. The cuts are marked by piles or stakes, which, however, are not easily seen until close-to; but the reefs show clearly and are easily avoided.

The mean rise and fall of tides is from 1 foot to 1½ feet along these keys; and there are strong tidal currents through the passages between the keys. The distance from Miami to Bahia Honda Harbor, by the inside passage, is 100 miles; from Bahia Honda to Key West, by the Hawk Channel, 33 miles; and from Bahia Honda Harbor to Key West, by Big Spanish Key Channel, Gulf of Mexico, and Northwest Channel, 49 miles.

Pilots for Hawk Channel and for the passage north of the keys can usually be found at Miami. Anchorages, sheltered from all ordinary weather, may be found anywhere along these passages, in the lee of the keys and reefs.

DIRECTIONS FOR THE PASSAGE NORTH OF THE KEYS.—The courses given here, if made good, will lead to the cuts through the reefs; but one must take into account cross currents, which, near the openings between keys, are often quite strong. During flood tide the current sets through from Hawk Channel and in the opposite direction during ebb tide.

From Miami take the ship channel through the dredged cut as marked by piles, and from the last one steer 186° true (**S ⅜ W** mag.) for 12 miles to a position 300 yards west of a pile which marks the western extremity of the reef west of Ragged Keys. About ½ mile west of this pile is a cluster of piles marking the north end of Featherbed Bank. Steer 142° true (**SE ½ S** mag.) for 1⅜ miles to a short cut, 50 feet wide and 6 feet deep, through a reef, marked by two little stakes. After leaving this cut steer 207° true (**SSW ¼ W** mag.) for 9 miles to a cut, 5 feet deep, through the shoal extending from Totten Key to Arsenicker Keys. This cut is about 1 mile long and is marked by piles along its eastern side and a cluster of piles near its southern end.

From the southern end of this cut steer 228° true (**SW ⅛ W** mag.) for 4¾ miles to a cut, 5 feet deep, near Card Point; it is marked by stakes and piles on both sides, and there is a blind passage opening into its western side. After leaving this cut steer 213° true (**SSW**

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¾ W mag.) for 1½ miles to a cut close under the mangrove point on the port hand. This cut, 5 feet deep, is marked by small stakes on both sides and leads into Barnes Sound.

Cross Barnes Sound on a 193° true (S by W mag.) course for 5 miles to Jewfish Creek, leading into Blackwater Sound. The passage is marked by small stakes and is crossed by a drawbridge. Keep to port at all openings. From Jewfish Creek steer 221° true (SW ½ S mag.) for 2¾ miles to a passage eastward of Bush Point, leading into Tarpon Basin. On entering Tarpon Basin haul sharply westward, avoiding the southeastern end; then head for the west corner of the basin, keeping close to the southern shore when up to the passage out. The southeast end of Tarpon Basin is shallow, and there is a shoal at the west end, on the north side of the channel to the outlet.

When clear of the passage out of Tarpon Basin, steer 215° true (SW by S mag.) for the cut through the mangroves, about 2 miles distant. On leaving this cut look out for a shoal on the starboard hand, and hold down 100 yards from the opening before turning; then steer 231° true (SW ⅜ W mag.) for Pigeon Key, passing a rock awash 200 yards on the port hand and a shoal about the same distance on the starboard hand. Circle north and west, half around Pigeon Key, at a distance of 500 yards from it, and then steer 176° true (S ½ E mag.) for the west side of Hammer Point.

Haul slowly westward to pass 400 yards northwest of Hammer Point and between it and a small stake about 600 yards northwest of the point, and then steer for a cut 1 mile west-southwest of Hammer Point. This cut is marked by small stakes on each side, visible at a short distance only. From this cut steer about 241° true (SW by W ¼ W mag.) to pass, close-to on the port hand, a pile close to a mangrove point, ¾ mile distant; and then steer about 218° true (SW ¾ S mag.) for another cut, ¾ mile farther. The last cut is through a clump of mangroves, which line each side of the passage and extend, scattered, for a short distance north and west.

From the mangrove cut steer 244° true (SW by W ½ W mag.) for 2¼ miles and then 252° true (WSW ¼ W mag.) for 3½ miles to a cut marked by a single stake on its southern side. At the change in course a small reef, awash at high tide, lies 400 yards on the starboard hand, and 2 miles farther a rock, marked by a pile, is 600 yards on the port hand. From this cut steer 228° true (SW ⅛ W mag.) for 4¾ miles to a cut southeast of the southernmost of three little keys (Bowlegs Keys). This cut is well marked by stakes on each side, and the reefs here show so clearly that the passage could be found easily without stakes.

Between the last two cuts is a passage, east of Lignum Vitae Key, to a drawbridge in the railroad, through which vessels may go to Hawk Channel.

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Long Key Fishing Camp is on the western end of *Long Key* and is reached by water from the north side of the keys. There are accommodations for fishermen at the camp and sheltered berths for a few small boats alongside the wharf. Fresh water and some gasoline can be had here during the winter season. A depth of 4 feet can be carried to the camp by steering, from the cut at Bowlegs Key, 226° true (**SW** mag.) for 4½ miles to a pile marking the northern end of a shoal off Long Key, and then following the shore of Long Key at a distance of ¼ mile to the camp. Or, from the same cut, steer 240° true (**SW** by **W** ⅛ **W** mag.) for 9 miles; thence 151° true (**SSE** ¾ **E** mag.) for 1 mile, past a beacon on the port hand, and then 114° true (**ESE** mag.) to the camp. The latter courses pass over a least depth of 5 feet.

DIRECTIONS TO KEY WEST (CONTINUED).—From the cut near Bowlegs Key, steer 240° true (**SW** by **W** ⅛ **W** mag.) for 10 miles to a position 300 yards south of a reef awash at high tide; and watch out for shallow places on each side. At the end of this course the reef referred to will be recognized easily by discolored water. The next course is 252° true (**WSW** ¼ **W** mag.), but if the preceding course has not been made good it will be necessary to alter the last course to get through a reef 1 mile from the last. There are several passages through this reef, the most southern of which is marked by stakes, but possesses no other advantage over the northern passage; the color of the water is a sufficient guide to any of them.

Steer 252° true (**WSW** ¼ **W** mag.) for 12 miles to a position 500 yards southeast of *Crescent Shoal* (bare at high tide); then 230° true (**SW** ¼ **W** mag.) for 1¾ miles to Bethel Bank, the most southern of several dry ridges. Follow along the north side of the bank at a distance of 300 yards, and from the west end steer 240° true (**SW** by **W** ⅛ **W** mag.) for 4¼ miles, across Moser Channel, to a position 300 yards north of a sandspit extending northward from the railroad. Moser Channel leads to a drawbridge, which offers the last opportunity for a masted vessel 22 feet high to get into Hawk Channel. From the last position steer 247° true (**SW** by **W** ¾ **W** mag.) for 4¾ miles to Bahia Honda Harbor.

Westward of Bahia Honda Harbor there is no sheltered passage practicable for a stranger. Local boats of 2½ feet draft find passages between the keys, but a stranger would be almost certain of getting aground. A stranger may either pass under the railroad bridge, which here has a clear headroom of 21½ feet above mean high water, and continue by way of Hawk Channel; or he may enter the Gulf through Big Spanish Key Channel and proceed northward of the keys. The choice of the two routes depends upon the direction of the wind and sea.

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DIRECTIONS FROM BAHIA HONDA HARBOR TO KEY WEST HARBOR—*By Hawk Channel.*—Pass under the railroad between any of the central piers. All spans have clear headroom (from the lowest part of the girders) of 21½ feet at mean high tide or 23 feet at mean low tide. Tidal currents attain a velocity of 3 to 4 knots through these openings at certain stages of the tide; flood tide sets northward and ebb tide southward. From the railroad steer 176° true (**S ½ E** mag.) for 1 mile, and then steer 241° true (**SW** by **W ¼ W** mag.) for 3½ miles. Then steer 258° true (**WSW ¾ W** mag.) for 24 miles, leaving Loggerhead Key red buoy (No. 12 L K) about ⅜ mile on the starboard hand, Nine-Foot Shoal beacon (red and black, white light) 150 yards on the port hand, black buoy No. 17 about ⅜ mile on the port hand, black buoy No. 19 P K about ⅛ mile on the port hand, and to the fairway buoy southeast of Key West. Then steer 289° true (**WNW ½ W** mag.) to red buoy No. 6, and from there to red buoy No. 8 and into Key West Harbor.

By Big Spanish Key Channel and Gulf of Mexico.—Big Spanish Key Channel trends northwestward from Bahia Honda Harbor for about 8 miles, then northward for 4 miles, along the west side of Big Spanish Key and a shoal extending north from this key, to the Gulf of Mexico. The minimum depth is 5 feet, which is about 1 mile south of Big Spanish Key. Stand up Bahia Honda Harbor on a 339° true (**NNW** mag.) course until a 317° true (**NW** mag.) course can be laid so as to pass 400 yards northeastward of No Name Key, the large key on the northwest side of the harbor. Then steer 317° true (**NW** mag.) for a distance of 3½ miles beyond the northeastern point of No Name Key to a position midway between Mayo and Crawl Keys (Mayo is the second key on the port hand above No Name, and Crawl Key is the next north of Mayo).

Then steer 305° true (**NW** by **W** mag.) for 2½ miles and then 317° true (**NW** mag.) for nearly a mile, until up to the shallow water south of Big Spanish Key. Here the channel is marked by small stakes with white finger boards pointing to the best water. The channel curves northward close to the west side of a shoal surrounding Big Spanish Key. From the last stake haul slowly to 339° true (**NNW** mag.) so as to bring the center of Big Spanish Key right astern, and steer this course into the Gulf. After clearing the shallow waters north of Harbor Key, steer 245° true (**SW** by **W ½ W** mag.) for about 28 miles to the entrance bell buoy of Northwest Channel, and be guided by the buoys into Key West Harbor.

Key West is the terminus of the Florida East Coast Railroad and is connected by steamship lines with New York, Tampa, Mobile, Galveston, and Habana. The harbor is west and north of the city, which is on the west end of the island, and is navigable for deep-draft vessels. The anchorage is due west of the city; and north of

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it, in a pocket between the shoals, known as Man of War Harbor. The wharves along the west side of the city belong to the Navy Department and Lighthouse Service; north of which are the commercial wharves, along the northwest and north sides of the city; the railroad wharf is the most northerly of all. Large vessels may go to most of these wharves; and at the head of the slips and in the cove south of the railroad wharf are convenient berths for small craft.

Provisions, ship chandlery, coal, gasoline, and fresh water can be had here. The facilities for making repairs to hulls and machinery of vessels are good and there are marine railways for hauling out vessels up to about 1,000 tons.

Storm warnings are displayed from a tower in Key West and at Sand Key.

LIST OF THE MOST NECESSARY CHARTS AND OTHER PUBLICATIONS COVERING THE INLAND WATERWAYS.

New York to Delaware River:

Chart 369. New York Bay and Harbor, price $0.75.

Chart 375. Raritan River, price $0.50.

Charts 126, 294, 295. Delaware River, price of each $0.50. Chart 126 will be canceled when chart 296 is published.

Chesapeake Bay to Neuse River:

Chart 78. Chesapeake Bay in one sheet, price $0.50.

Charts 136, 135, 134, 133, 1223, 1222. Chesapeake Bay in six sheets, price of each $0.50.

Chart 78 can be used in place of these charts—for through courses—in Chesapeake Bay.

Chart 1227. Norfolk to Albemarle Sound, price $0.50.

Charts 1228, 1229, 142, 143. Albemarle and Pamlico Sounds, price of each $0.50.

Chart 144[2]. Neuse River, price $0.40.

Beaufort Harbor to Winyah Bay:

Charts 147, 148, 149, 150, 151, 152, price of each $0.50.

Charts 147 and 150 show Beaufort Harbor and Cape Fear River, and with these exceptions Chart 11—Cape Hatteras to Cape Romain, price $0.50—can be used in place of these charts for coasting.

Winyah Bay to St. Johns River:

Charts 153, 154, 155, 156, 157, and part of 158, price of each $0.50.

Chart 577, Fernandina to Jacksonville, price $0.50, is recommended for the passage from Fernandina to St. Johns River and for going up to Jacksonville.

St. Johns River to Miami:

Charts 158, 159, 160, 161, 162, 163, 164, 165, price of each $0.50.

Miami to Key West:

Charts 166, 167, 168, 169, price of each, $0.50.

The route is covered in the following publications:

Inside Route Pilot, New York to Key West, price $0.20.

U. S. Coast Pilot, Part VI, Chesapeake Bay and Tributaries, price $0.50.

U. S. Coast Pilot, Section D, Cape Henry to Key West, price $0.50.

Tide Tables, Atlantic Coast ports of the United States, price $0.15.

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The following publications of the Bureau of Lighthouses describe the aids to navigation, and can be obtained free of charge on application to the Division of Publications, Department of Commerce, Washington, D. C.:

List of Lights and Fog Signals, Atlantic and Gulf Coasts of the United States.

Lists of Buoys and other Aids to Navigation for the following lighthouse districts:

Third District, Narragansett Bay to Cape May, including Long Island Sound, New York Harbor and tributaries.

Fourth District, Delaware Bay and River.

Fifth District, Cape Henlopen to Cape Lookout, including Chesapeake Bay and North Carolina Sounds.

Sixth District, Coast and Tributaries from New River Inlet, N. C., to Jupiter Inlet, Fla.

Seventh District, Florida Reefs and Gulf Coast to Cedar Keys.

A catalogue showing additional charts, principally of the harbors along the route, can be obtained free of charge on application to the Coast and Geodetic Survey, Washington, D. C., or to any of its agents. A list of agents for the sale of charts and other publications of the Coast and Geodetic Survey is given in the catalogue, and also in the first notice each month of the Notice to Mariners, published weekly by the Bureau of Lighthouses and the Coast and Geodetic Survey.

LIST OF COAST PILOTS OF THE COAST AND GEODETIC SURVEY.

	Price.
U. S. Coast Pilot, Atlantic Coast, Parts I–II, from St. Croix River to Cape Ann.	$0.50
U. S. Coast Pilot, Atlantic Coast, Part III, from Cape Ann to Point Judith....	.50
U. S. Coast Pilot, Atlantic Coast, Part IV, from Point Judith to New York, including Long Island Sound.....	.50
U. S. Coast Pilot, Atlantic Coast, Part V, from New York to Chesapeake Bay entrance.....	.50
U. S. Coast Pilot, Atlantic Coast, Part VI, Chesapeake Bay and tributaries....	.50
U. S. Coast Pilot, Atlantic Coast, Section D, Cape Henry to Key West.....	.50
U. S. Coast Pilot, Atlantic Coast, Part VIII, Gulf of Mexico, from Key West to the Rio Grande.....	.50
Inside Route Pilot, New York to Key West.....	.20
U. S. Coast Pilot, Pacific Coast, California, Oregon, and Washington.....	.50
U. S. Coast Pilot, Pacific Coast, Alaska, Part I, from Dixon Entrance to Yakutat Bay.....	.50
U. S. Coast Pilot, West Indies, Porto Rico.....	.50

COAST PILOT NOTES, ALASKA AND HAWAIIAN ISLANDS.

Bulletin No. 38. Prince William Sound, Cook Inlet, Kodiak Island, and route from Unalaska to Chignik.

Coast Pilot Notes from Yakutat Bay to Cook Inlet and Shelikof Strait.

Coast Pilot Notes on Bering Sea and Arctic Ocean.

Coast Pilot Notes on Hawaiian Islands.

SAILING DIRECTIONS, PHILIPPINE ISLANDS.

Section I. North and west coasts of Luzon and adjacent islands.

Section II. Southwest and south coasts of Luzon and adjacent islands.

Section III. Coasts of Panay, Negros, Cebu, and adjacent islands.

Section IV. Coasts of Samar and Leyte and the east coast of Luzon.

Section V. Coasts of Mindanao and adjacent islands.

Sections VI and VII. Mindoro Strait, Palawan Island, and Sulu Sea and Archipelago.

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APPENDIX I.

PILOTAGE AND HARBOR FEES.

NORTH CAROLINA.

Extracts from Chapter 104, Revised Laws of North Carolina, 1905.

4962. RATES OF PILOTAGE FOR HATTERAS AND OCRACOKE.—Branch pilots of Ocracoke or Hatteras shall be entitled to receive of the commander of such vessel as they may have in charge the following pilotage, namely: For every vessel of sixty and not over one hundred and forty tons burden, from the other side of the bar, at any place within the limits of the pilot ground, to Beacon Island road, or Wallace's channel, ten cents for each ton, and the further sum of two and a half cents for each ton over one hundred and forty, and two dollars for each vessel over either of the swashes (that is, over said swashes either to or from Beacon Island road, or Wallace's channel, or over any shoal lying intermediate between either of said swashes and Beacon Island road of Wallace's channel); for every ship or vessel from the mouth of the swash to either of the ports of New Bern or Washington, one dollar per foot, and for every ship or vessel from the same place to the port of Edenton, twelve dollars; and to the port of Elizabeth City, ten dollars; and the same allowance down as up, and outward as inward.

4969. RATES OF PILOTAGE FOR OLD TOPSAIL INLET AND BEAUFORT HARBOR.—The pilotage for Old Topsail inlet and Beaufort harbor shall be as follows: For vessels drawing eight feet and under, two dollars per foot; ten feet and over eight, two dollars and fifty cents per foot; twelve feet and over ten, three dollars and fifty cents per foot; all over twelve feet, four dollars per foot. The above fees to be collectible in Beaufort harbor from Middle marsh to Lewis thoroughfare. For every vessel piloted without these bounds an additional charge of fifty cents per foot may be charged. The commissioners shall have the same printed or written on every license or branch issued by them, and every pilot shall exhibit his license to the master of every vessel he has in charge, when demanded by said master. No vessel entering Old Topsail inlet without a pilot shall be required to take one on going to sea; nor shall any vessel be required to take a pilot that has to enter the harbor in distress. (*As amended 1909.*)

4970. VESSEL UNDER SIXTY TONS NOT LIABLE FOR PILOTAGE.—No pilot, acting under the authority of the commissioners of navigation

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for Old Topsail inlet, shall be entitled to pilotage for any vessel under sixty tons burden, unless such vessel shall have given a signal for a pilot, or otherwise shall have required the assistance of a pilot.

4972. RATES OF PILOTAGE FOR BOGUE INLET.—The branch pilots for Bogue Inlet shall be entitled to receive of the commander of such vessel as they may have charge of, the following pilotage, namely: For bringing any vessel into the said inlet, drawing less than seven feet, from the outside of the bar to the anchorage before the town, or the customary place in Hill's channel, one dollar per foot; for a vessel drawing more than seven feet, one dollar and fifty cents per foot; and the same fees for pilotage outward as inward.

4978. PILOTS REFUSED, ENTITLED TO PAY.—If a branch pilot shall go off to any vessel bound in, and offer to pilot her over the bar, the master or commander of such vessel, if he refuses to take such pilot, shall pay to such pilot, if not previously furnished with one, the same sum as is allowed by law for conducting such vessel in, to be recovered before a justice of the peace, if the sum be within his jurisdiction: Provided, that the first pilot, and no other, who shall speak such vessel so bound in shall be entitled to the pay provided for in this section.

4980. RATES OF PILOTAGE ANNEXED TO COMMISSION.—The commissioners of navigation for the several ports of this state shall annex to the branch or commission, by them given to each pilot, a copy of the fees to which such pilot is entitled.

CAPE FEAR RIVER—PILOTAGE.

Extracts from Chapter 625, Laws of North Carolina, 1907.

SEC. 13. All vessels, coastwise or foreign, over sixty (60) gross tons, shall, on and after the 1st day of May, 1907, take a State-licensed pilot from sea to Southport, and from Southport to sea, and the rates of pilotage shall be the rates given in column No. 1 below, designated "From sea to Southport, or vice versa;" the employment of pilots from Southport to Wilmington and from Wilmington to Southport is optional, but any vessel taking a pilot from Southport to Wilmington, or from Wilmington to Southport, shall employ only a State-licensed pilot, and the rates of pilotage shall be the rates given in column No. 2, designated "From Southport to Wilmington, or vice versa."

SEC. 14. Every master of a vessel who shall detain a pilot at the time appointed, so that he can not proceed to sea, though the wind and weather permit, shall pay such pilot $3 per day during the time of his actual detention.

SEC. 15. Any vessel coming into Southport from sea without the assistance of a pilot, the wind and weather being such that such assistance or service could have been reasonably given, shall not be liable for pilotage inward from sea, and shall be at liberty to depart without payment of any pilotage, unless the services of a pilot be secured.

SEC. 16. The first pilot speaking a vessel shall be entitled to the pilotage fees over the bar to Southport, and out to sea again, provided said pilot shall be ready and willing to serve as pilot when the vessel is ready to depart.

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SEC. 17. Any vessel coming in from sea for harbor shall not be required to take a pilot either from sea inward or back to sea.

Column No. 1: Rate from sea to Southport, or vice versa.		Column No. 2: Rate from Southport to Wilmington, or vice versa.	
6 feet and under	$10.76	6 feet and under	$6.46
7 feet and under	13.06	7 feet and under	7.83
8 feet and under	14.83	8 feet and under	8.89
9 feet and under	16.09	9 feet and under	10.01
10 feet and under	21.08	10 feet and under	12.64
11 feet and under	25.55	11 feet and under	15.33
12 feet and under	28.58	12 feet and under	17.14
12½ feet and under	30.30	12½ feet and under	18.18
13 feet and under	31.84	13 feet and under	19.11
13½ feet and under	34.15	13½ feet and under	20.49
14 feet and under	38.91	14 feet and under	23.35
14½ feet and under	42.74	14½ feet and under	25.64
15 feet and under	45.08	15 feet and under	27.04
15½ feet and under	47.17	15½ feet and under	28.30
16 feet and under	50.32	16 feet and under	30.19
16½ feet and under	54.13	16½ feet and under	32.48
17 feet and under	57.34	17 feet and under	34.41
17½ feet and under	61.02	17½ feet and under	36.72
18 feet and under	64.05	18 feet and under	38.55
18½ feet and under	67.17	18½ feet and under	40.34
19 feet and under	71.72	19 feet and under	43.04
19½ feet and under	74.96	19½ feet and under	44.99
20 feet and under	78.30	20 feet and under	46.98
20½ feet and under	82.81	20½ feet and under	49.39
21 feet and under	87.50	21 feet and under	52.50
21½ feet and under	93.75	21½ feet and under	56.25
22 feet and under	100.00	22 feet and under	60.00
22½ feet and under	106.25	22½ feet and under	63.75
23 feet and under	114.06	23 feet and under	68.44
23½ feet and under	121.88	23½ feet and under	73.12
24 feet and under	131.25	24 feet and under	78.75
25 feet and under	143.50	25 feet and under	89.00

CAPE FEAR RIVER—HARBOR FEES.

Extracts from Chapter 104, Revised Laws of North Carolina, 1905.

4958. * * * The harbor-master shall have power and is required—

6. To collect from all vessels arriving in the port of Wilmington the following fees and no others, to-wit: If over one hundred tons and under three hundred tons, three dollars; if over three hundred tons and under five hundred tons, five dollars; if over five hundred tons and under seven hundred tons, seven dollars; if over seven hundred tons, ten dollars.

SOUTH CAROLINA.

PORT OF GEORGETOWN—PILOTAGE.

6 feet and under	$16.00	13 feet and under	$54.00
7 feet and under	19.00	13½ feet and under	60.00
8 feet and under	22.00	14 feet and under	66.00
9 feet and under	25.00	14½ feet and under	72.00
10 feet and under	28.00	15 feet and under	80.00
10½ feet and under	32.00	15½ feet and under	90.00
11 feet and under	36.00	16 feet and under	100.00
11½ feet and under	40.00	16½ feet and under	110.00
12 feet and under	44.00	17 feet and under	120.00
12½ feet and under	48.00	17½ feet and under	130.00

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PORT OF CHARLESTON—PILOTAGE.

6 feet or under	$14.00	22 feet or under	$128.00
7 feet or under	16.50	23 feet or under	146.00
8 feet or under	18.50	24 feet or under	168.00
9 feet or under	21.00	24½ feet or under	174.00
10 feet or under	27.00	25 feet or under	180.00
11 feet or under	32.50	25½ feet or under	186.00
12 feet or under	36.50	26 feet or under	192.00
13 feet or under	41.00	26½ feet or under	198.00
14 feet or under	50.00	27 feet or under	204.00
15 feet or under	57.50	27½ feet or under	210.00
16 feet or under	64.50	28 feet or under	216.00
17 feet or under	73.50	28½ feet or under	222.00
18 feet or under	82.00	29 feet or under	228.00
19 feet or under	92.00	29½ feet or under	234.00
20 feet or under	100.00	30 feet or under	240.00
21 feet or under	112.00		

Piloting around Ashley or Cooper Rivers	$8.00
Detention per day	4.00
Docking and streaming	4.00

CHARLESTON—HARBOR FEES.

1. For the purpose of meeting the expenses attendant upon the execution of the foregoing regulations, and providing for the safety and proper accommodation of vessels at this port, the following tax or fee is imposed upon all vessels arriving here, and will be collected by the harbor master upon their arrival in such manner as shall be most expeditious:

Coastwise steamships, monthly	$6.00
schooners, per trip	2.00
brigs, per trip	2.50
Foreign steamships, per trip	12.00
barks, per trip	6.00
brigs, per trip	3.00

ST. HELENA, PORT ROYAL, AND INLAND WATERS—PILOTAGE.

Feet.	Pilotage.	Feet.	Pilotage.	Feet.	Pilotage.
6	$18.00	15½	$71.00	21½	$161.50
7	21.00	16	76.50	22	170.50
8	24.00	16½	82.50	22½	180.00
9	27.00	17	89.00	23	190.50
10	31.00	17½	97.00	23½	201.00
11	35.00	18	104.50	24	212.00
12	40.00	18½	112.00	24½	223.00
12½	43.50	19	120.00	25	235.00
13	47.00	19½	128.00	25½	249.00
13½	51.00	20	136.50	26	264.00
14	55.00	20½	143.50	26½	280.00
14½	60.00	21	152.50	27	297.00
15	66.00				

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Each drop, $10; detention, $4 per day; dockage, $4.

From Port Royal to Wilsons Mill	$12.00
From Port Royal to Sewardville	12.00
From Port Royal to Bull River (without steam)	30.00
From Port Royal to Bull River (with steam)	15.00
From Beaufort to Bull River (without steam)	25.00
From Beaufort to Bull River (with steam)	12.50
From Beaufort or Port Royal to Calibogue	25.00

GEORGIA.

DOBOY AND SAPELO BAR, AND DARIEN AND SAPELO RIVER—PILOTAGE.

Draft in feet.	Bar pilotage to upper buoy or safe anchorage.	River pilotage from upper buoy or safe anchorage to Darien or any other landing.	Total.
6	$11.00	$8.00	$19.00
7	12.00	9.00	21.00
8	13.00	10.00	23.00
9	16.00	12.00	28.00
10	18.00	13.00	31.00
11	21.00	14.00	35.00
12	23.00	19.00	42.00
12½	26.00	21.00	47.00
13	31.00	23.00	54.00
13½	34.00	25.00	59.00
14	35.00	26.00	61.00
14½	36.00	27.00	63.00
15	41.00	30.00	71.00
15½	43.00	31.00	74.00
16	46.00	33.00	79.00
16½	48.00	34.00	82.00
17	52.00	37.00	89.00
17½	54.00	39.00	93.00
18	58.00	41.00	99.00
18½	60.00	43.00	103.00
19	64.00	46.00	110.00
19½	67.00	48.00	115.00
20	70.00	49.00	119.00
20½	75.00	50.00	125.00
21	82.00	53.00	135.00
21½	90.00	55.00	145.00
22	105.00	57.00	162.00
22½	120.00	60.00	180.00
23	135.00	62.00	197.00

Drop, $7; every day's detention, $3; foreign vessels, 50 per cent additional to the above rates.

PORT OF SAVANNAH—PILOTAGE.

RULE 28. For delivering instructions to vessels touching at Tybee Bar for orders, pilot shall be entitled to collect one-half Bar and Cockspur pilotage, inward and outward, except in cases where vessels are to return to Savannah to complete cargo, then the fee for such services shall be $15.

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RULE 29. The following rates are established for moving vessels, for completing their loading, and for other purposes:

Draft in feet.	Savannah to Tybee or Tybee to Savannah.	Savannah to Venus Point or Venus Point to Savannah.	Savannah to Four Mile Point or Four Mile Point to Savannah.	Savannah to Five Fathoms or Five Fathoms to Savannah.
6	$8.00	$8.00	$6.00	$4.00
7	8.00	8.00	6.00	4.00
8	8.00	8.00	6.00	4.00
9	10.00	10.00	8.00	6.00
10	10.00	10.00	8.00	6.00
11	11.00	11.00	10.00	8.00
12	11.00	11.00	10.00	8.00
13	12.00	11.00	10.00	8.00
14	14.00	14.00	12.00	10.00
15	17.00	15.00	13.00	10.00
16 and up.	18.00	16.00	14.00	12.00

From Tybee to Venus Point same as from Venus Point to Savannah.

From Tybee to Four Mile Point same as from Savannah to Venus Point.

From Venus Point to Four Mile Point same as from Four Mile Point to Savannah.

Quarantine to Savannah same as from Tybee to Savannah.

Detention per day $4.32.

And all vessels bound up or down the river, and detained one tide, to alter the trim of the vessel, to pay the pilot a drop of $7.50, but no detention for that day.

TYBEE BAR AND SAVANNAH RIVER—PILOTAGE.

Draft of ship, feet and under.	Bar to Cockspur.	Cockspur to Savannah.	Total.
6	$8.75	$5.25	$14.00
7	10.25	6.25	16.50
8	12.00	7.00	19.00
9	13.50	8.00	21.50
10	16.75	10.25	27.00
11	20.50	12.00	32.50
12	23.00	13.50	36.50
13	25.50	16.50	41.00
14	31.25	18.75	50.00
15	36.00	21.50	57.50
16	40.50	24.00	64.50
17	46.00	27.50	73.50
18	51.00	31.00	82.00
19	57.50	34.50	92.00
20	62.50	37.50	100.00
21	70.00	42.00	112.00
22	80.00	48.00	128.00
23	91.25	54.75	146.00
24	105.00	63.00	168.00
24½	108.75	65.25	174.00
25	112.50	67.50	180.00
25½	116.25	69.75	186.00
26	120.00	72.00	192.00
26½	123.75	74.25	198.00
27	127.50	76.50	204.00
27½	131.25	78.75	210.00
28	135.00	81.00	216.00
28½	138.75	83.25	222.00
29	142.50	85.50	228.00
29½	146.25	87.75	234.00
30	150.00	90.00	240.00

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PORT OF SAVANNAH—HARBOR FEES.

The harbor fees, as established by ordinance, shall be as follows:

By each transient brig or schooner, four ($4) dollars. By each transient ship or bark, six ($6) dollars. By each transient steamship, fifteen ($15) dollars. By each coastwise steamship running regularly to this port, six ($6) dollars per month. By each bark, barkentine, brig, or schooner engaged in the coastwise trade, four ($4) dollars, payable not more than twice in every 12 months. By each sailing vessel or steamer plying inland, measuring 40 feet or more, 2 cents per foot over all measurement, payable quarterly, in advance.

PORT OF BRUNSWICK—PILOTAGE.

For the bar of St. Simons and Turtle River and the bar of St. Andrews and Satilla River.

Feet.	Pilotage.	Feet.	Pilotage.	Feet.	Pilotage.
6	$16.75	12	$43.75	18	$93.00
6½	18.75	12½	46.75	18½	99.00
7	20.25	13	49.25	19	105.00
7½	21.75	13½	52.25	19½	111.00
8	23.00	14	58.00	20	117.00
8½	24.50	14½	67.00	20½	123.00
9	26.00	15	71.00	21	129.00
9½	27.75	15½	74.00	21½	135.00
10	31.75	16	79.00	22	142.00
10½	37.00	16½	82.25	22½	160.00
11	39.00	17	87.00	23	185.00
11½	41.25	17½	89.50	23½ and up	200.00

Detention, per day, $4.

FLORIDA.

Extracts from the General Statutes of Florida, 1906.

1300. RATES OF PILOTAGE.—The board of pilot commissioners of each port may fix the rates of pilotage which shall be paid by any vessel entering their port; but in no case shall they fix the rates greater than the rates now provided by law, as follows: All steamers or vessels entering any port or leaving the same, shall be subject to pay to any licensed pilot performing duty on board, or to the pilot who shall first speak to such steamer or vessel, the following rates of pilotage: For steamers or vessels drawing 6 feet, or less than the same, two dollars per foot; for steamers or vessels drawing from 6 to 10 feet, three dollars per foot; for steamers or vessels drawing from 10 to 14 feet, four dollars per foot; for steamers or vessels drawing from 14 to 20 feet, five dollars per foot; for steamers or vessels drawing over 20 feet, six dollars per foot These rates shall apply to all steamers or vessels, whether owned wholly by citizens of this state or not: *Provided*, That all steamers or vessels carrying the regular United States mails shall pay half pilotage only: *Provided, further*, That all steamers or vessels drawing less than 6 feet of water, and having a coastwise license, shall be exempt from paying whole or half pilotage, unless they employ a pilot.

1326. COMPENSATION.—Harbor masters respectively shall receive from the master, owner or consignee of vessels coming into the port

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for which he is appointed as aforesaid for the services rendered by himself or his deputy, under the provisions of this section, not exceeding the sum of twenty dollars for each vessel, according to the amount and value of the services rendered.

PORT OF JACKSONVILLE—PILOTAGE.

Extracts from the Rules and Regulations.

1. The master of any vessel entering the port of Jacksonville, who does not accept the services of a pilot shall be compelled to pay the full legal rates of pilotage.

7. Any pilot detained on board of any vessel by the master or quarantine officer, shall receive for each and every day's services the sum of five dollars per day over and above his pilotage.

12. The rates of pilotage to be charged and collected by the pilots on the St. Johns Bar, on all steamers and vessels entering the port of Jacksonville, shall be as follows:

$2.50 per foot draft, into Mayport.

$3.00 per foot draft, out of Mayport.

Vessels desiring to take pilots from Mayport to Jacksonville, $1.50 per foot draft each way.

PORT OF KEY WEST.

Extracts from the Rules and Regulations.

SEC. 1. The master of any vessel entering the port of Key West, who does not accept the services of a pilot shall be compelled to pay the full legal rates of pilotage, provided the vessel be spoken outside the following limits:

If she be entering by Main Ship Channel she must be spoken outside the Western Head Buoy, or No. 1. If by Hawk Channel, she must be spoken east of Mid-channel buoy, intersecting Southeast Channel and Hawk Channel, Key West Light bearing NW. ¼ N.

If entering by Southeast Channel, must be spoken outside of No. 4 red buoy, Sand Key bearing SW. by W. ¾ W.

Should a vessel entering the port of Key West without being spoken by a licensed pilot outside the foregoing limits, the first pilot speaking her thereafter shall be entitled to full outward pilotage.

SEC. 13. The rates of pilotage as now established by law are as given in section 1300 preceding.

And all vessels drawing 14 feet or less shall pay the sum of ten dollars for dropping from one anchorage to another and those drawing over 14 feet shall pay the sum of twenty dollars.

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Meteorological table compiled by the United States Weather Bureau.

NORFOLK, VA. OBS. STATION, LAT. 36° 51′ N., LONG. 76° 17′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.										Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.					Average fall.	Number of days 0.01 in. or more.	Max. fall in 24 hours.	Average hourly velocity.	Highest velocity.	Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.								N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.13	30.82	29.24	1.58	40.4	48.5	33.2	15.3	80	6	74	77	5	3.37	12	2.20	8.6	56	10	10	3	5	10	8	7	8	1	0.4	1.7
February	30.11	30.83	29.04	1.79	41.8	49.9	33.7	16.2	81	2	79	75	5	3.35	11	3.45	9.4	59	10	10	3	6	7	7	5	8	0	0.7	1.7
March	30.03	30.65	29.44	1.21	47.7	56.8	39.7	17.1	92	14	78	76	5	4.28	12	2.78	9.5	55	8	13	5	8	10	7	5	6	0	0.4	1.7
April	30.01	30.59	29.36	1.23	56.0	65.2	47.5	17.7	95	24	71	74	4	3.79	11	5.15	9.4	55	8	9	4	9	12	8	4	6	0	0.2	0.3
May	30.00	30.37	29.63	0 74	66.2	75.3	57.5	17.8	98	38	60	75	4	4.07	12	3.78	8.2	56	7	10	6	10	13	9	3	4	0	0.3	0.9
June	30.00	30.42	29.67	0.75	74.4	83.1	66.1	17.0	102	49	53	77	5	4.33	11	5.97	7.5	49	4	10	5	10	13	11	3	4	0	0.3	0.3
July	30.00	30.38	29.61	0.77	78.4	87.2	70.7	16.5	102	57	45	78	4	5.80	13	3.60	7.4	52	4	8	5	10	15	14	3	3	0	0.1	0.7
August	30.00	30.27	29.68	0 59	76.7	84.4	69.9	14.5	100	56	44	80	4	5.97	12	6.03	6.9	60	5	10	5	11	14	10	3	3	1	0.2	0.2
September	30.06	30 37	29.79	0.56	71.7	79.1	65.1	14.0	100	40	60	80	4	4.06	9	4.23	7.5	55	7	16	6	10	8	7	2	3	1	0.1	0.5
October	30.07	30.49	29.65	0.84	61.3	68.8	54.1	14.7	89	31	58	79	4	3.91	8	6.29	8.2	50	11	15	5	6	8	6	4	6	1	0.2	1.5
November	30.11	30.65	29.44	1.21	51.2	59.3	43.3	16.0	80	18	62	74	5	2.72	8	5.48	8.4	50	11	9	3	4	11	8	5	8	1	0.3	1.7
December	30.13	30.58	29.49	1.09	43.0	50.8	35.7	15.1	75	6	69	76	4	3.49	10	2.52	8.4	58	12	7	3	5	10	10	7	7	1	0.2	1.8
Mean	30.05	.....	.....	.....	59.1	67.4	51.4	16.0	....	....	....	77	4	.....	.....	.....	8.3	.....	....	....	....	....	....	....	....	....	....	.....	....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	49.14	129	.....	.....	.....	97	127	53	94	131	105	51	66	6	3.4	13.0

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Meteorological table compiled by the United States Weather Bureau.

HATTERAS, N. C. OBS. STATION, LAT. 35° 13′ N., LONG. 75° 41′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.												Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.										Average number of times from observations at 8 a. m. and 8 p. m.)											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 in. or more.	Max. fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.14	30.72	29.32	1.36	45.8	52.8	39.5	13.3	72	12	36	84	5.1	4.94	9	2.05	16.4	60	13	14	2	2	4	12	8	7	0	1.4	3.0
February	30.11	30.74	29.31	1.36	46.6	51.8	38.5	13.3	71	18	33	84	5.0	4.48	9	4.34	17.8	60	10	15	3	2	3	11	4	8	0	1.5	3.1
March	30.04	30.62	29.27	1.24	51.4	60.1	47.1	13.0	81	31	26	82	4.7	5.47	12	1.82	16.4	67	8	18	4	3	5	14	6	4	0	1.0	3.4
April	30.01	30.59	29.38	1.07	58.0	65.8	53.5	12.3	80	36	25	81	4.0	4.40	10	2.98	16.0	60	7	12	4	3	5	18	5	6	0	1.1	0.9
May	30.01	30.45	29.20	1.06	67.1	74.0	62.7	11.3	86	47	22	83	3.8	4.14	8	4.72	13.6	54	5	12	5	5	7	19	6	3	0	0.4	1.0
June	30.01	30.35	29.50	0.72	74.4	79.8	69.2	10.6	91	55	21	84	3.9	4.33	10	3.25	13.1	50	2	12	5	5	6	22	6	2	0	0.1	0.3
July	30.01	30.33	29.33	0.98	78.6	83.7	73.2	10.5	93	64	20	84	3.7	6.13	11	3.42	12.6	60	4	7	4	5	6	28	5	3	0	0.3	0.2
August	30.00	30.32	29.54	0.74	78.2	83.6	73.1	10.5	91	63	21	84	3.9	5.84	12	4.34	10.3	49	3	11	6	5	7	22	6	2	0	0.1	0.0
September	30.06	30.48	29.70	0.76	74.7	80.1	70.4	9.7	91	57	19	81	4.0	5.33	8	2.89	12.6	60	5	22	6	4	4	12	5	2	0	0.2	0.5
October	30.06	30.46	29.37	1.06	66.0	71.0	60.0	11.0	85	41	25	81	3.8	6.01	8	3.03	14.9	63	11	24	3	2	4	7	4	7	0	0.8	1.0
November	30.11	30.59	29.09	1.33	56.7	61.3	49.9	11.4	78	27	30	82	3.8	4.67	7	3.38	15.4	66	14	12	2	1	2	11	7	11	0	0.3	1.3
December	30.13	30.66	29.34	1.16	48.8	54.9	41.2	13.7	75	20	30	84	4.9	5.11	10	2.55	15.8	61	13	12	2	1	3	10	10	11	0	1.0	2.0
Mean	30.06	.....	.....	.....	62.2	68.2	56.5	11.7	....	....	....	83	4.2	.....	.....	.....	14.6	.....	....	....	....	....	....	....	....	....	....	....	....	....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	60.85	116	.....	.....	.....	95	171	46	38	56	186	72	66	0	8.2	16.7

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Meteorological table compiled by the United States Weather Bureau.

WILMINGTON, N. C. OBS. STATION, LAT. 34° 14′ N., LONG. 77° 57′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.										Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.					Average fall.	Number of days 0.01 in. or more.	Max. fall in 24 hours.	Average hourly velocity.	Highest velocity.	Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.								N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.14	30.91	29.18	1.73	45.6	55.9	38.0	17.9	80	9	71	78	5	3.50	11	4.56	8.7	46	9	12	3	2	6	10	9	10	1	0.2	2.0
February	30.12	30.76	29.07	1.69	47.7	57.4	39.4	18.0	80	5	75	79	5	3.39	10	3.23	9.8	51	8	10	3	2	6	10	8	9	0	0.6	1.4
March	30.05	30.73	29.18	1.55	53.7	64.0	45.6	18.4	94	20	74	78	5	3.50	11	5.26	9.7	54	7	11	6	3	8	15	6	6	0	0.5	1.1
April	30.03	30.61	29.30	1.31	60.4	70.2	52.2	18.0	90	28	62	76	4	2.86	9	2.72	9.8	48	5	8	6	4	9	14	7	7	0	0.1	0.5
May	30.01	30.45	29.39	1.06	69.1	78.4	61.3	17.1	97	38	59	79	4	4.03	9	2.90	8.6	52	4	10	6	5	9	17	7	4	0	0.1	0.3
June	30.01	30.39	29.41	0.98	75.5	84.3	68.5	15.8	100	51	49	81	5	5.62	12	7.03	7.9	42	3	9	5	4	9	19	9	2	0	0.2	0.1
July	30.01	30.35	29.14	1.21	78.7	87.1	72.1	15.0	103	58	45	83	5	6.97	14	7.33	7.6	50	3	7	4	5	8	24	8	3	0	0.1	0.2
August	30.00	30.31	29.46	0.85	77.6	86.1	71.1	15.0	99	56	43	84	5	6.51	15	8.04	6.7	68	4	10	5	5	9	17	9	3	0	0.1	0.4
September	30.05	30.48	29.12	1.36	73.1	82.0	66.1	15.9	96	42	54	83	4	5.27	9	7.30	7.1	64	8	18	6	4	6	9	5	4	0	0.2	0.8
October	30.06	30.67	29.09	1.58	63.3	73.0	55.2	17.8	92	31	61	81	4	3.74	8	4.51	7.9	60	12	20	6	3	4	5	4	7	1	0.1	1.3
November	30.12	30.73	28.98	1.75	54.1	64.5	45.8	18.7	83	20	63	79	4	2.45	8	2.78	7.7	48	10	13	3	2	6	8	9	9	0	0.2	1.5
December	30.15	30.76	29.22	1.54	47.2	57.5	39.0	18.5	78	10	68	79	4	3.12	10	2.98	8.1	48	10	11	3	3	5	10	10	10	0	0.4	1.7
Mean	30.06	.....	.....	.....	62.2	71.7	54.5	17.2	.....	.....	.....	80	4.5	.....	.....	.....	8.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	51.05	126	.....	.....	.....	83	139	56	42	85	158	91	74	2	2.8	11.3

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Meteorological table compiled by the United States Weather Bureau.

CHARLESTON, S. C. OBS. STATION, LAT. 32° 47′ N., LONG. 79° 56′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.												Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.					Average fall.	Number of days 0.01 in. or more.	Max. fall in 24 hours.	Average hourly velocity.	Highest velocity.	Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.								N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.15	30.83	29.17	1.66	49.3	57.5	42.6	14.9	80	10	70	77	5.1	3.45	10	3.98	8.9	44	12	10	5	2	4	11	10	8	0	0.2	4.0
February	30.12	30.66	29.20	1.46	51.7	59.2	44.3	14.9	80	7	73	77	5.2	3.41	10	2.79	10.1	56	7	9	5	3	4	11	9	8	0	0.8	3.4
March	30.06	30.71	29.33	1.38	57.2	65.5	50.4	15.1	94	24	70	77	4.8	3.72	9	3.14	9.7	55	6	9	7	5	8	14	6	7	0	0.5	3.0
April	30.03	30.79	29.29	1.50	63.8	71.7	57.0	14.7	90	32	58	74	4.3	2.99	8	8.30	9.9	67	6	7	7	5	10	13	7	5	0	0.6	0.6
May	30.01	30.46	29.48	0.98	72.4	79.6	65.9	13.7	98	45	53	75	4.5	3.47	9	5.58	9.6	53	4	8	8	6	12	15	6	3	0	0.4	0.6
June	30.01	30.35	29.31	1.04	78.5	85.5	72.4	13.1	100	51	49	77	5.1	5.39	11	5.95	9.1	54	4	6	7	6	14	15	6	2	0	0.4	0.2
July	30.03	30.36	29.53	0.83	81.3	88.0	75.3	12.7	104	64	40	80	5.5	7.26	13	5.14	8.5	48	2	5	5	5	15	18	9	3	0	0.1	0.1
August	30.01	30.28	29.33	1.05	80.3	87.0	74.6	12.4	100	62	38	81	5.4	6.97	13	5.89	8.0	106	5	7	7	5	12	15	7	4	0	0.7	0.4
September	30.04	30.43	29.27	1.16	76.2	82.7	70.8	11.9	100	49	51	81	4.8	5.46	10	7.00	9.0	62	7	16	11	6	8	6	4	2	0	0.5	1.2
October	30.06	30.59	28.91	1.68	67.1	74.3	60.5	13.8	93	37	56	78	4.3	3.93	7	9.55	9.3	64	15	18	7	5	3	4	4	6	0	0.7	2.0
November	30.12	30.70	29.14	1.56	58.1	65.9	50.7	15.2	83	23	60	78	4.2	2.87	8	5.84	8.4	46	13	12	5	3	5	8	7	7	0	0.1	2.8
December	30.15	30.74	29.28	1.46	51.3	59.0	44.1	14.9	78	13	65	78	5.0	3.15	9	3.46	8.5	50	12	12	5	3	4	9	8	9	0	0.2	3.0
Mean	30.07	.....	.....	.....	65.6	73.0	59.1	13.9	....	....	....	78	4.8	.....	.....	.....	9.1	.....	....	....	....	....	....	....	....	....	....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	52.07	117	.....	.....	.....	93	119	79	54	99	139	83	64	0	5.2	21.3

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Meteorological table compiled by the United States Weather Bureau.

JACKSONVILLE, FLA. OBS. STATION, LAT. 30° 20′ N., LONG. 81° 39′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.										Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.					Average fall.	Number of days 0.01 in. or more.	Max. fall in 24 hours.	Average hourly velocity.	Highest velocity.	Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.								N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*												
January	30.15	30.66	29.49	1.17	53.9	64.1	46.5	17.6	81	15	66	80	5.3	3.12	9	3.09	7.5	59	11	12	4	5	5	7	7	10	1	0.3	0.1
February	30.12	30.60	29.37	1.23	56.9	66.5	48.6	17.9	86	10	76	79	5.1	3.43	9	3.99	8.0	75	7	10	4	5	6	8	6	10	0	0.6	0.0
March	30.06	30.64	29.42	1.22	61.9	72.4	54.2	18.2	91	26	65	76	4.4	3.52	8	4.47	8.3	68	6	11	6	10	6	10	6	7	0	0.4	0.0
April	30.04	30.43	29.32	1.11	67.6	77.7	59.5	18.2	92	34	58	73	4.2	2.72	7	4.81	8.4	51	5	9	7	12	6	9	5	7	0	0.6	0.0
May	30.00	30.41	29.55	0.86	74.2	83.8	66.2	17.6	98	46	52	74	4.3	4.25	10	9.06	7.6	56	4	9	9	15	7	9	5	4	0	0.4	0.0
June	30.01	30.26	29.53	0.73	79.0	88.4	71.9	16.5	101	54	47	79	5.3	5.53	13	5.12	7.5	68	3	6	7	14	8	13	6	3	0	0.6	0.0
July	30.03	30.29	29.71	0.58	80.9	90.4	74.0	16.4	104	66	38	80	5.5	6.20	15	4.55	7.2	55	3	4	5	15	11	17	5	2	0	0.6	0.0
August	30.01	30.26	29.04	1.22	80.1	89.7	73.7	16.0	101	64	37	81	5.3	6.21	15	6.18	6.9	56	4	5	7	14	9	15	5	3	0	0.6	0.0
September	30.00	30.25	29.19	1.06	77.3	85.8	71.2	14.6	99	49	50	83	5.2	8.03	13	9.86	7.0	70	8	16	11	10	4	6	2	3	0	0.3	0.0
October	30.02	30.49	29.04	1.45	69.6	78.3	62.9	15.4	95	37	58	81	4.6	5.06	10	5.15	7.7	62	17	18	7	4	2	3	4	7	0	0.2	0.0
November	30.10	30.50	29.35	1.15	61.3	71.0	53.8	17.2	86	26	60	82	4.5	2.19	8	3.75	7.0	40	15	13	4	5	3	4	5	10	1	0.1	0.0
December	30.14	30.61	29.45	1.16	55.2	65.1	47.3	17.8	82	14	68	82	4.8	2.99	8	4.43	7.0	51	13	11	3	5	5	6	7	11	1	0.4	0.0
Mean	30.06	.....	.....	.....	68.2	77.8	60.8	17.0	....	....	....	80	4.9	.....	.....	.....	7.5	.....	....	....	....	....	....	....	....	....	....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	53.25	125	.....	.....	.....	96	124	74	114	72	107	63	77	3	5.1	0.1

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Meteorological table compiled by the United States Weather Bureau.

JUPITER, FLA. OBS. STATION, LAT. 26° 57′ N., LONG. 80° 04′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0-10.	Precipitation.			Wind.											Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.					Average fall.	Number of days 0.01 in. or more.	Max. fall in 24 hours.	Average hourly velocity.	Highest velocity.	Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.								N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*													
January	30.10	30.48	29.66	0.82	64.3	72.4	58.4	14.1	83	24	59	81	4.9	3.58	10	6.38	10.7	45	6	5	9	8	7	4	6	17	0	0.1	0.2
February	30.08	30.45	29.54	0.91	66.3	73.4	59.1	14.3	87	27	50	80	4.8	3.05	8	3.62	10.8	51	7	3	6	8	9	6	5	12	0	0.2	0.1
March	30.05	30.39	29.56	0.83	69.4	76.5	62.6	13.9	89	33	56	78	4.1	3.12	7	4.97	11.3	46	5	4	9	11	11	5	7	10	0	0.0	0.2
April	30.04	30.34	29.61	0.73	72.2	78.9	65.3	13.6	90	39	51	76	4.2	2.63	7	4.25	11.2	60	5	6	10	11	9	6	6	7	0	0.2	0.1
May	29.98	30.28	29.64	0.64	76.4	82.9	69.9	13.0	93	53	40	79	4.6	4.76	10	8.76	10.2	48	4	7	12	13	9	7	7	3	0	0.0	0.0
June	30.01	30.25	29.63	0.62	79.6	85.2	72.8	12.4	95	64	31	83	5.5	6.93	14	9.26	8.9	49	2	4	9	18	11	8	5	3	0	0.1	0.0
July	30.03	30.25	29.76	0.49	81.0	87.0	74.7	12.3	96	67	29	82	4.9	5.37	14	3.40	8.1	40	2	2	8	20	12	10	6	2	0	0.0	0.0
August	30.00	30.19	29.20	0.99	81.5	87.6	75.0	12.6	96	68	28	83	4.8	5.85	15	4.92	8.1	60	3	3	10	16	10	10	7	3	0	0.2	0.0
September	29.96	30.16	29.30	0.86	80.6	85.8	74.4	11.4	93	61	32	84	5.5	9.56	17	6.67	9.3	78	4	12	14	12	7	4	3	4	0	0.4	0.0
October	29.96	30.30	29.18	1.12	76.8	81.8	70.7	11.2	94	48	46	81	5.4	9.48	15	13.18	11.7	72	7	17	12	6	4	4	4	8	0	0.6	0.0
November	30.05	30.32	29.71	0.61	71.6	77.5	65.7	11.9	87	36	51	79	4.9	3.05	9	5.06	11.1	42	6	10	14	6	4	3	5	12	0	0.1	0.1
December	30.10	30.48	29.63	0.85	66.3	73.2	59.6	13.6	86	24	62	81	5.0	2.87	9	5.75	10.5	38	6	7	10	6	5	5	7	16	0	0.0	0.3
Mean	30.03	.....	.....	.....	73.8	80.2	67.4	12.8	....	....	....	80	4.8	.....	.....	.....	10.2	.....	....	....	....	....	....	....	....	....	....	....	....	....
Total	.....	.....	.....	.....	.....	.....	.....	.....	....	....	....	.....	.....	60.25	135	.....	.....	.....	57	80	123	135	98	72	68	97	0	1.9	1.0

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Meteorological table compiled by the United States Weather Bureau.

KEY WEST, FLA. OBS. STATION, LAT. 24° 33′ N., LONG. 81° 48′ W.

Month.	Barometer at 32° F. and mean sea level.				Air temperature.							Average relative humidity.	Average amount of clouds, 0–10.	Precipitation.			Wind.										Number of days gales 40 miles or over.	Number of days fog.
	Mean.	Extremes.			Mean.				Extremes.									Average number of times (observations at 8 a. m. and 8 p. m.) from—											
	For month.	Highest.	Lowest.	Range.	For month.	Mean max.	Mean min.	Range.	Highest.	Lowest.	Range.			Average fall.	Number of days 0.01 in. or more.	Max. fall in 24 hours.	Average hourly velocity.	Highest velocity.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		
	Ins.	*Ins.*	*Ins.*	*Ins.*	°	°	°	°	°	°	°	%		*Ins.*		*Ins.*												
January	30.10	30.50	29.71	0.79	68.8	74.4	65.0	9.4	90	41	49	81	4.2	1.98	7	3.97	11.1	58	10	23	13	6	3	1	1	5	0	0.3	0.3
February	30.07	30.42	29.60	0.82	70.8	75.4	66.1	9.3	87	44	43	79	3.7	1.64	6	2.99	10.8	49	9	13	13	11	3	1	1	5	0	0.3	0.1
March	30.05	30.47	29.70	0.77	72.8	77.8	69.0	8.8	89	48	41	76	3.1	1.48	4	4.52	10.8	56	8	12	19	12	3	1	1	6	0	0.3	0.0
April	30.02	30.37	29.63	0.74	75.5	80.5	71.3	9.2	91	54	37	73	3.2	1.30	4	3.23	10.5	48	7	11	20	10	3	1	2	6	0	0.2	0.0
May	29.97	30.25	29.68	0.57	79.0	84.0	74.6	9.4	93	63	30	74	4.0	3.36	8	5.83	9.3	54	6	9	23	11	3	2	2	6	0	0.1	0.0
June	29.99	30.26	29.62	0.64	82.2	87.0	77.2	9.8	100	69	31	76	5.5	4.25	12	5.48	7.9	50	3	5	21	17	6	3	2	3	0	0.1	0.0
July	30.03	30.24	29.77	0.47	83.7	88.7	78.5	10.2	100	68	32	74	5.0	3.59	13	4.00	7.6	52	2	5	28	16	4	3	2	2	0	0.0	0.0
August	29.98	30.20	29.67	0.53	83.8	88.8	78.3	10.5	100	68	32	75	5.1	4.69	14	4.04	7.4	44	2	7	24	15	5	4	2	3	0	0.1	0.0
September	29.94	30.17	29.13	1.04	82.5	87.4	77.3	10.1	97	69	28	73	5.0	6.79	16	7.90	8.0	87	3	14	23	11	4	2	1	2	0	0.3	0.0
October	28.94	30.28	28.47	1.81	78.7	83.0	74.7	8.3	93	59	33	78	4.4	5.38	13	11.23	11.2	100	7	26	14	5	2	3	2	3	0	0.2	0.0
November	30.02	30.45	29.65	0.80	74.3	78.3	70.4	7.9	91	51	40	79	3.8	2.36	8	8.86	11.2	52	8	30	12	4	1	1	1	3	0	0.0	0.0
December	30.08	30.52	29.63	0.89	70.1	74.4	66.0	8.4	88	44	44	80	4.0	1.84	7	3.93	11.0	43	9	26	12	6	2	1	1	5	0	0.2	0.2
Mean	30.02	.....	.....	.....	76.8	81.6	72.4	9.2	.....	.....	.....	77	4.2	.....	.....	.....	9.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	38.66	113	.....	.....	.....	74	181	222	124	39	23	18	49	0	2.1	0.6

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AGENCIES OF THE COAST AND GEODETIC SURVEY.

Maine—
- Addison Point: V. H. Nash.
- Augusta: J. F. Pierce.
- Bangor: Snow & Nealley Co., 98 Broad Street.
- Bar Harbor: Albert W. Bee.
- Bath: Charles A. Harriman, 106 Front Street.
- Belfast: Newton S. Lord, 31 Front Street.
- Blue Hill: H. B. Darling.
- Boothbay Harbor: R. G. Hodgdon.
- Camden: Eugene M. Clark.
- Castine: C. Fred Jones.
- Damariscotta: R. C. Reed.
- Eastport: Bucknam & Colwell Co.
- Harrington: Wm. N. Dyer.
- Jonesport: E. B. Sawyer.
- Lubec: J. W. Case.
- Machias: W. B. Parlin.
- McKinley: Frank McMullin.
- Millbridge: E. W. Wallace.
- New Harbor: Samuel Tibbetts.
- North Haven: C. S. Staple.
- Pemaquid Harbor: Chas. A. Farrin.
- Portland: Wm. Senter & Co., 51 Exchange Street.
- Rockland: E. R. Spear & Co., 408 Main Street.
- Vinal Haven: F. E. Littlefield.

Vermont—
- Burlington: L. W. Fennell, customhouse.

Massachusetts—
- Barnstable: V. D. Bacon.
- Boston: W. E. Hadlock & Co., 132 State Street; C. C. Hutchinson, 152 State Street.
- Fall River: George E. Bamford, 7 Granite Block.
- Gloucester: W. F. Chisholm & Son, 161 Main Street.
- Marblehead: Stearns & McKay.
- Nantucket: Obed G. Smith.
- New Bedford: A. C. Smith, 27 William Street.
- Provincetown: M. C. Atwood.
- Salem: A. F. Hitchings, customhouse.
- Vineyard Haven: E. R. Tilton.

Rhode Island—
- Block Island: C. C. Ball.
- Newport: J. T. O'Connell, 89 Long Wharf; W. H. Tibbetts, 185 Thames Street.
- Providence: Goff & Page, customhouse.

Connecticut—
- Bridgeport: J. H. Shannon, customhouse.
- Hartford: Robert D. Stevens, customhouse.
- New Haven: Edward A. Welch, customhouse.

Connecticut—Continued.
- New London: Edwin Keeney & Co., corner Bank and State Streets.
- South Norwalk: Chas. J. Prescott.
- Stamford: Fred. A. Taff.
- Stonington: James H. Stivers, 72 Water Street.

New York—
- Albany: B. Lodge & Co., 91 North Pearl Street.
- College Point: Albert Humm.
- Greenport: George B. Preston.
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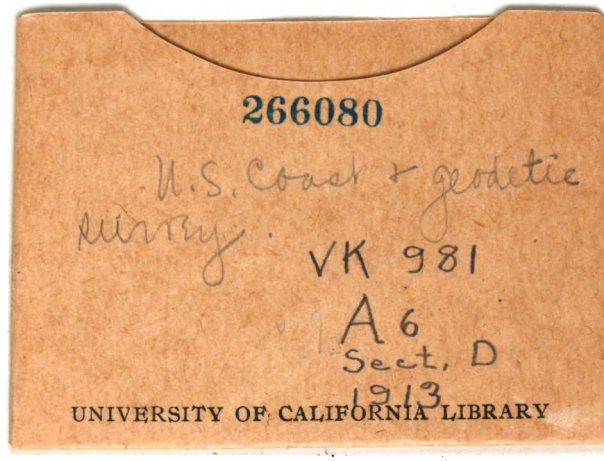
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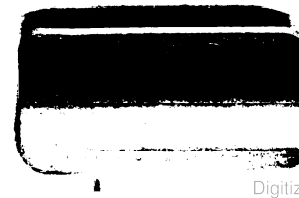

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